AN ANALYSIS OF THE RELATIONSHIP BETWEEN TECHNOLOGY AND STRATEGY AND HOW THEY SHAPED THE CONFEDERATE STATES NAVY

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This study investigates the use of technology by the Confederate States of America to develop naval strategy and ultimately the Navy during the American Civil War. The study concentrates on the building and use of: ironclads to break the blockade and coastal defense, torpedoes (mines) for coastal defense, and Submarines to help break the blockade at Charleston. The use of technology had a significant influence on the Confederate Navy not only on the strategic, but also on the operational and the tactical levels of war. Operational campaigns were planned and executed around the presence or absence of confederate ironclads by both the North and the South. Battles were won, lost, or never fought due to the presence of confederate torpedoes laid in southern harbors. The threat of Confederate submarines caused Union blockading squadrons to reduce the capabilities of catching runners by moving the fleet out of the submarines tactical range. Today's Navy, in its quest for new technology, faces a similar situation as the Confederate Navy did in 1861. We must seek new technology to enhance our warfighting skills not to look for the "ultimate weapon," as Mallory first thought of the ironclad.

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ABSTRACT

AN ANALYSIS OF THE RELATIONSHIP BETWEEN TECHNOLOGY AND STRATEGY AND HOW THEY SHAPED THE CONFEDERATE STATES NAVY, by LCDR Wesley A. Brown, USN, 171 pages.

This study investigates the use of technology by the Confederate States of America to develop naval strategy and ultimately the Navy during the American Civil War. The study concentrates on the building and use of: ironclads to break the blockade and coastal defense, torpedoes (mines) for coastal defense, and Submarines to help break the blockade at Charleston.

The use of technology had a significant influence on the Confederate Navy not only on the strategic, but also on the operational and the tactical levels of war. Operational campaigns were planned and executed around the presence or absence of confederate ironclads by both the North and the South. Battles were won, lost, or never fought due to the presence of confederate torpedoes laid in Southern harbors. The threat of Confederate submarines caused Union blockading squadrons to reduce the capabilities of catching runners by moving the fleet out of the submarines tactical range.

Today's Navy, in its quest for new technology, faces a similar situation as the Confederate Navy did in 1861. The Navy must seek new technology to enhance warfighting skills and not simply look for the "ultimate weapon," as the Confederate Navy first thought of the ironclad.

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INTRODUCTION

> In your hands, my dissatisfied fellow-countrymen, and not in mine, is the momentous issue of civil war. The Government will not assail you. You can have no conflict without being yourselves the aggressors. You have no oath registered in heaven to destroy the Government, while I shall have the most solemn one to "preserve, protect, and defend it." (Lincoln 1861, 223-224)

By the time President Lincoln gave his inaugural address in March 1861, seven states had seceded from the Union and appointed Jefferson Davis as the first President of the Confederate States of America. Within months, six more states would join the Confederacy. Davis, knowing the Union would not allow the "rebels" to break from the Union peacefully had to band these southern states together and form a military to fight for their way of life (Coski 1996, 3).

One of the many problems facing the newly formed confederacy was to attempt to do something never tried by a nation before. To build a navy while at war with an enemy that already had one of the largest navies in the world (Luraghi 1996, 15). The Confederacy had a unique situation that enabled them to build a navy directly in concert with the development of the naval strategy used to defeat their enemy. This could be accomplished in one of two ways. First, they could allow the current available ships, weapons, and tactics to dictate the strategy. Second, they could develop the strategy and let it dictate the type of navy to build.

In view of the shortfalls facing the Confederacy, especially in their economy and available resources, the South decided to develop a strategy that would best counter the Union's navy, then build a navy accordingly. While developing its strategy, the South

realized whatever type of navy it built, it would be smaller than that of its foes. Therefore, the Confederates looked to technology to counter the numerical advantage of the Union's navy. Specifically, they wanted a highly maneuverable steam cruiser for commerce raiding, armored ships for blockade running, rifled guns for more accurate and lethal fires, and submarine weaponry for harbor defense.

This thesis analyzes the use of technology by the Confederates to develop their naval strategy and ultimately build the Confederate Navy and answers the primary question: What were the significant factors that affected the success or failure of the technological-based naval strategy? While answering this question, there are several secondary questions to analyze. What was the Confederate war strategy, if any, and its influence on the naval strategy? What technology did the Confederates use? How did the political and economic conditions in the South shape the development of the Confederate navy?

Several essential terms will be used throughout the thesis, and their definitions are provided in a glossary. The term "technology," however, is an integral concept to chapter one and beyond, so it is defined as follows:

By the middle of the nineteenth century, the United States was undergoing a revolutionary transformation in maritime technology brought on by the Industrial Revolution. The Industrial Revolution was the process of change from an agrarian, handicraft economy to one dominated by industry and machine manufacture. This process began in England in the 1800s and spread to other parts of the world, including the United States. One feature involved in the Industrial Revolution was technological.

These changes in technology included: the use of new basic materials, chiefly iron and steel; the use of new energy sources, including both fuels and motive power, such as coal, the steam engine, electricity, petroleum, and the internal-combustion engine; a new organization of work known as the factory system, which entailed increased division of labor and specialization of function; important developments in transportation and communication, including the steam locomotive and steamship; and the increasing application of science to industry. These technological changes made necessary a tremendously increased use of natural resources and the mass production of manufactured goods. The advancement in maritime technology was so great Alfred Thayer Mahan wrote: "A naval captain who fought the Invincible Armada would have been more at home in the typical warship of 1840 than the average captain of 1840 would have been in the advanced [ship] types of the American Civil War" (Mahan 1907, 3). Now that term technology has been defined, the following paragraphs will outline the thesis basis.

The thesis has found two primary limitations: (1) few archival records on the Confederate States' Navy and (2) time to complete the thesis. When the Confederates evacuated Richmond in 1865, the Navy Department burned most of its records thereby limiting the amount of primary sources (Luraghi 1996, xi). Some primary records exist in the *Official Records of the Union and Confederate Navies in the War of the Rebellion*, as well as in periodicals and newspapers, some of which are on the Internet. Through the outstanding research by Raimondo Luraghi, Thomas Scharf, William Still, and others, are adequate secondary sources for the thesis exist. To complete the thesis in the allotted time, concurrently with the Command and General Staff College curriculum, the thesis

research will be limited in time and distance. Travel will be limited to the Lawrence, Kansas, area to perform research. However, the Combined Arms Research Library is an outstanding research library. What cannot be found there, can be requested from libraries across the country. This thesis also uses the Internet for data to help reduce the research time. The Internet has volumes of information, including primary and secondary sources on reputable educational sites.

Six constraints will be imposed on this thesis to ensure it remains feasible. First, although the Union's naval strategy is worthy of research, an in-depth study of it will not be done. Rather, the thesis will examine it in relation to its effects on the Confederate naval strategy. There have been several major writings on Union strategy, specifically on: Gideon Welles, Union Secretary of the Navy, and General Winfield Scott, General in Chief, the architect of the grand strategy (Anaconda) for the Union.

Second, the thesis has limited research on the political climate in the South. After the country split, the South had to piece together some form of government. The Southern states seceded from the Union due to a perceived threat to their sovereign state rights. Therefore, a strong central government, such as the United States, would not be adopted (Fowler 1990, 41). Discussion are limited to the context of how this political dilemma affected the decision making of the Confederate leaders.

Third, in the beginning, the Confederacy had a minimal and fragile economy. The thesis limits the study of the economic condition in the South to establishing how it affected the building of the Confederate States Navy.

Fourth, Southern industry was not prepared to build a Navy. Compared to the North, the South had fewer factories and mines, one private shipyard, and one foundry

(Anderson 1962, 13). Therefore, a limited discussion of the industry or the lack thereof, to its direct impact on the shaping of the Confederate Navy.

Fifth, Stephen Mallory, Confederate Secretary of the Navy, was the guiding force behind their naval strategy concept and the building of the navy itself. Although Mallory directly or indirectly influences all aspects of this thesis, the research will focus on tangible evidence for decisions made while building the Confederate navy. It will not explore other influences, specifically on Mallory, such as background, education, political motives, or other personal beliefs.

Sixth, the Confederate naval strategy encompasses several operational and tactical levels of war, all of which are worthy of research. This thesis will not include riverine, privateering, commerce raiding, or amphibious warfare. Specific areas were chosen because they best illustrate the use of technology in the overall Confederate naval strategy.

This study will be a historical analysis using primary and secondary sources to determine how technology influenced the Confederate naval strategy and the building of the navy, and to analyze the effects it had on the war. The use of tactics was not included in the research during individual battles but focus more on the strategic and operational levels of the war.

Of all naval strategies in the history of the United States, Stephen Mallory's strategy for the Confederate Navy may well be the best suited for today's Naval officer to analyze. Mallory's task was to build a navy virtually from scratch while his new nation was at war with an enemy that already had one of the world's largest, albeit unprepared, navies. If that was not hard enough, he also had to formulate a strategy to help his new

nation win the war. Whether the strategy adopted was a success or failure, it does not take away from its importance. The Confederates were up against a well-established Union Navy. Considering the state of the South, Mallory knew his Navy would be smaller than the navy of his foe. Therefore, he looked to technology to counter the numerical advantage of the Union Navy, as apparent in this letter to Representative Charles M. Conrad of Louisiana:

> The most formidable wooden frigate would be powerless in contrast with such a ship; and the employment of ironclad ships by one naval power, must compel every other to have them, without regard to cost, or to occupy a position of known or admitted inferiority upon the sea. I regard the possession of an iron-armored ship, as a matter of the first necessity. Such a vessel at this time could traverse the entire coast of the United States, prevent all blockades, and encounter, with a fair prospect of success, their entire Navy. (ORN Ser. II, 1:742)

Mallory also looked to technology in several other aspects in naval warfare, such as Naval Gun Fire, Mine Warfare, and Submarine Warfare. It could be said that he was forced to ask his navy to perform a task that is being asked of today's Navy; "do more with less."

Chapter two provides background information on the status of the Confederate Navy at the start of the Civil War. It includes how the nation grew in the 1800s in relation to population, economy, and land mass. It offers information on the issues that were central to the secession of thirteen states and ultimately to armed conflict. It will give information on the formation of the Confederate Government and finally the formulation of the Confederate strategy for the Civil War.

This thesis focuses on three areas in the Confederate naval strategy: the use of ironclads in breaking the blockade and harbor defense (chapter three), the use of

torpedoes (mines) in coastal defense (chapter four), and the revolutionary use of semisubmersible and submersible boats in breaking the blockade (chapter five).

CHAPTER TWO

EVENTS LEADING TO THE CIVIL WAR

Before conducting an in-depth study of any aspect of the American Civil War, we must be familiar with what brought our country to engage in a war that killed more Americans than all other military conflicts combined.

> The casualties at Antietam numbered four times the total suffered by American soldiers at the Normandy beaches on June 6, 1944. More than twice as many Americans lost their lives in one day at Sharpsburg as fell in combat in the War of 1812, the Mexican War, and the Spanish-American War *combined.* And in the final reckoning, American lives lost in the Civil War exceed the total of those lost in all the other wars the country has fought added together, world wars included. (McPherson 1988, xviii)

Most people blame slavery for the War Between the States. In fact, it is said to "reject slavery as the cause for secession eliminated the characteristic that most distinguished the North from the South" (Beringer et al. 1986, 426). To do this is like treating the symptom, not the cause. The causes of the Civil War are deeprooted and very complex and "slavery as a moral issue has too long been the red herring dragged across the trail" (Tresfousse 1971, 52). The causes of war all stemmed from one basic fact: the North was an industrial society and the South was agrarian. This was profoundly evident even as our forefathers drafted the Constitution to join our states under one government. The Constitution was written so one section (North or South) could not control the national government. This idea would work as long as there was a balance in numbers of people and more importantly, numbers of states (Tresfousse 1971, 54). Thomas Jefferson believed the country he helped forge for generations to come would be sufficient to absorb one hundred generations of America's growth. By 1850,

two generations later, Americans had filled the lands of Thomas Jefferson and spread as far as the Pacific Coast (McPherson 1988, 9).

At the time of the Louisiana Purchase in 1803, the United States was an insignificant nation by European standards. But by 1850, the United States became the most populous nation in the Western world except for Russia and France. In 1860 the country contained nearly thirty-two million people, four million of them slaves, a growth rate four times faster than Europe's and six times the world average. Three factors explained this phenomenon: a higher birth rate, lower death rate, and immigration (Mcclelland and Zeckhauser 1982, 87). Due to this rapid growth, Americans started looking for more territory in which to expand.

Whether or not it caused the Civil War, slavery did cause a distinct political split, between the North and the South. However, the country's extraordinary expansion is what caused slavery to be so volatile. Congress had tried to alleviate this problem, for the Louisiana Purchase, in 1820 by splitting it at latitude 36 degrees 30 minutes (with slavery allowed in Missouri as an exception north of that line). Nevertheless, this only postponed the crisis (McPherson 1988, 8).

While the country was expanding through "manifest destiny," many Americans in the North felt that expansion was a means for proslavery advocates to extend slavery and even obtain control of the free states. Territorial acquisition since the Revolution had added the slave states of Louisiana, Missouri, Arkansas, Florida, and Texas to the republic, while adding only Iowa (1846) on the side of free states. About ten years later, some southerners felt the only way to ensure the survival of their way of life was to annex all of Mexico to "re-establish" political equality within the Union. The division

between North and South concerning expansion of the Nation as well as slavery came to an explosive head in Kansas.

Due to the Missouri Compromise, the Nebraska territory would enter the Republic as a "free slave" state, a situation southerners did not want. Illinois Democrat Stephen A. Douglas was on the Senate committee on territories and a champion of America's manifest destiny. Douglas drafted a bill the Kansas-Nebraska Act that split the area into the two territories of Nebraska and Kansas and added language to allow people living in the territory to decide the slavery issue. This law (Kansas-Nebraska Act passed by Congress in May 1854) "may have been the most important single event pushing the nation toward civil war. Kansas-Nebraska finished the Whig party and gave birth to a new, entirely northern Republican Party" (McPherson 1988, 121).

Thanks to a gang of border thugs from Missouri, Kansas' initial vote was pro-slavery causing the *Leavenworth Herald* to proclaim, "All hail! Come on, Southern men! Bring your slaves and fill up the territory. Kansas is saved" (Nichols 1954, 29). Congress investigated the voting practices in Kansas and found them fraudulent. Consequently, Kansas would continue to divide the nation and now the Democratic Party. President James Buchanan, Democrat from Pennsylvania, decided to try to end the troubles over Kansas by urging Congress to admit the territory as a slave state. This angered Republicans and further alienated members of his own party. On 3 December 3 1857, Douglas went to the White House to confront President Buchanan on the "trickery and juggling" to give Kansas statehood under "such a travesty of popular sovereignty" (McPherson 1988, 166). Douglas warned the president he would destroy the Democratic Party in the North. The clash between Douglas and President Buchanan over the issue of

slavery in Kansas raised the stakes between Democrats, setting the stage for the split of the party and ensured the election of a Republican president in 1860.

By 1860, President Lincoln's northern states were on the leading edge of the Industrial Revolution. From New York to Boston to Philadelphia, the North had several established shipyards, foundries, and factories with a highly trained workforce that, if needed, could focus on the war effort. The South, at this same time, was determined to hold on to the traditional agrarian way of life. The feeling of most southerners was that no man could depend on another for his livelihood and consider himself truly free. With these two divergent philosophies, it is easy to understand why only 40 percent (and declining) of the northern population worked in agriculture and 80 percent of southern workers did (McPherson 1988, 40). This explains why most of the machine-tool industry and advanced factories were located in the North, mainly in New England. The philosophies of the two sections also had an impact on their viewpoints on education.

The North felt the future of the nation stemmed from having an educated populace. More than 95 percent of adults in northern states were literate compared to 80 percent in southern states. A more telling number was the amount of children, ages five to nineteen attending school. In the North, three-quarters of the children were in school for an average of six months out of the year. Conversely, only one-quarter of children in the South attended school for an average of three months out of the year. These facts could explain why out of 143 important inventions in the United States from 1790 to 1860, 93 percent were in northern free states (McPherson 1988, 20). With an understanding of the distinct political, industrial, and educational differences between

North and South, it is possible to understand why the South faced a bleak economic situation from which they were unable to recover.

The first obstacle the new leadership in the South faced was hard currency. The North had 65.5 percent of specie (coined money) to the South's 32.5 percent (Luraghi 1996, 18). With the prospect of war, the South had to resort to taxation to finance it. This obstacle would prove to be a difficult task to overcome given the Confederate States weak central government. The cornerstone of the Confederate States of America was the sovereignty of the states. It was obvious the South had to tax to produce capital to fund the impending war. The Confederate Constitution prohibited high protective taxes like the one used by the Union to raise over $300,000,000 in gold and silver for the war effort. Instead, the form of taxation Confederate leaders chose was a cotton export or revenue tax (Eaton 1954, 234). Therefore, the South relied on exports for its economic base. These same exports were also to finance the war through taxation. The problem with this logic was that the South did not have sufficient ships to take its commerce overseas or the naval ships to protect them. The South had fallen into a "catch 22" dilemma, needing ships to export goods for money and money to buy ships for maritime commerce. Although the economic situation in the South seemed to be overwhelming, "many Confederates agreed that numbers or resources did not provide the margin, although they disagreed on what did" (Beringer et al. 1986, 424). Some historians believe it was not the lack of resources, but the war organization of the South that was to blame for their shortcomings during the Civil War. Before the war, several events had ramifications throughout the young country's existence. These include the selection of the President's Cabinet and ultimate power of state governors.

Organizing a Nation

The first order of business for the newly formed Confederate Congress was to develop a provisional constitution. It took just a few days to adopt a Confederate Constitution similar to the United States Constitution with minor changes. It retained the power of Congress to "raise armies and to provide and maintain a Navy" (Luraghi 1996, 3). The few changes dealt mainly with slavery and states rights. On 12 February 1861, Congress created a series of standing committees, among them was the Committee of Naval Affairs headed by Charles M. Conrad, a wealthy plantation owner from New Orleans. As explained in a later paragraph, this committee performed a significant disservice to the navy in creating confusion by conducting investigations into the finances of the navy. On 14 February 1861, the committee received the authority to call Southern naval experts deemed necessary for consultation. On that same day, they dispatched telegrams to U.S. Naval officers of Southern blood instructing them to resign and proceed to Montgomery, Alabama (Luraghi 1996, 3). One of these officers was Rafael Semmes, who later in the war had great success in commerce raiding. Before his sea service, President Davis drafted him, while in Montgomery, to travel north and procure arms and ammunition for the army. This took one of the best naval officers and assigned him to the ground force for four critical months. As Mallory learned in the first months in his new position, he had to persuade those Southern leaders around him need for a Confederate Navy (Luraghi 1996, 8). Most leaders, including Davis, believed the South's fate was in the hands of the army. Davis, a West Point graduate, saw the navy as an auxiliary for the army (Fowler 1990, 42).

The next step for President Davis was to form a cabinet. The cabinet consisted of six members: Secretary of State, Robert Toombs of Georgia; Secretary of Treasury, Christopher G. Memminger of South Carolina; Secretary of War, Leroy Pope Walker of Alabama; Secretary of the Navy, Stephen R. Mallory of Florida; Attorney General, Judah P. Benjamin of Louisiana; and the Postmaster General, John H. Reagan of Texas.

Although several of these positions and the men occupying them affected the way the Confederate Navy evolved, Mallory was the true driving force in the development of the Navy. There were a couple of relationships within this cabinet that were key.

Although Mallory had contentions with some of the members, the personalities of the Cabinet members were not in direct conflict. Davis and his Cabinet worked, for the most part, in reasonable harmony. While there were differences of opinion, Cabinet "meetings were not marked by passion or strife" (Patrick 1944, 64). Two secretaries of war and one secretary of the treasury had a negative impact on the Confederate Navy. As for the War Department, Leroy Walker was inept and his successor did not support Mallory in personnel issues. For the Treasury Department, a lack of support with the amount and timeliness of finances caused delays and embarrassment.

Leroy Walker (February-September 1861) was appointed for all the wrong reasons. Davis did not personally know him, but he came recommended by several of his friends. His main selling point to the Confederate Congress and Davis was being the only person from Alabama nominated to the Cabinet (Patrick 1944, 104). In his short period in office, he demonstrated numerous times he did not consider the navy while requesting funds, supplies, and personnel from Congress. Mallory, Benjamin, or Memminger "doubted that Walker possessed the ability to conduct the War Department

successfully" (Patrick 1944, 114). Walker was forced to resign 15 September 1861. Unfortunately, this lack of support was at a very critical time for the navy, with Mallory in a "tooth and nail" struggle trying to get funds and personnel to build a navy to defend his new nation's vast coastline from an already-established enemy fleet.

The second secretary of war detrimental to the establishment of the navy was James Seddon (November 1862-Feburary 1865). Throughout the war, the Confederate Navy seriously lacked sailors. The army received most of the able-bodied men entering the war effort for the South. The problem became so bad that Congress passed several laws to help Mallory's plight. Even with government pressure, army commanders did not obey these laws. Men with naval backgrounds that wanted to be the in the navy was sent to the ground force. There were hundreds of men who Mallory requested by name and who had extensive navy experience for transfer to his navy. When Mallory used direct pressure on Seddon to permit these transfers, Seddon called his commanders to permit the transfer but left the final decision to the commanders (Scharf 1882, 41).

Mallory was constantly at odds with Christopher Memminger, Secretary of the Treasury (February 1861-July 1864), over the Treasury Department's inability to finance the building of the naval fleet. There were many occasions when debt payments occurred late. Lack of money and untimely payment to creditors were directly responsible for delays in the construction of several naval warships. Two reasons for Memminger's inability to pay were the use of government bonds for payment and the priority of money to the army. Memminger used government bonds vice treasury notes to pay naval bills. Under this system, it could take up to forty days to receive actual payment. Also, Congress required Memminger to pay army bills before those of the navy. The problem

so infuriated Mallory it prompted him to write to Davis "has been a source of great embarrassment to this Department and complaint of its creditors" (U.S. Navy Department 1921, 1:714).

Due to the structure of the Confederates States of America's Constitution, making individual states rights stronger than the central government, President Davis' problems in running the new country were formidable. Because of this fundamental weakness of the government, whenever there was a conflict with state governors, the state was always victorious (Patrick 1944, 34). This inherent weakness also hindered the Confederate Navy. As each state seceded, it organized a state navy of its own. They were to be brought within the Confederate States Navy umbrella within the first year, but the problem of independent state navies was never completely solved (Anderson 1962, 13).

There were also problems internal to the Cabinet. Most people were selected for their position for political reasons, not qualifications. As shown in the list of original names, all represented a particular geographic location. Several men who Davis wanted in his Cabinet lacked backing in Congress. Therefore, the process of selecting his Cabinet took valuable time, time needed by the military to prepare for what many believed inevitable--war.

One of the Cabinet selections Davis fought for was Stephen Mallory, Secretary of the Navy. In fact, it was the only Cabinet nomination held up by Congress. Many Confederate Congressmen as well as fellow Floridians, felt he was a Northern sympathizer. This notion began when as chairman of the United States Senate Committee on Naval Affairs he acted against the Southern states to prevent the seizure of Fort Pickens. There was no basis for this allegation, although later in life he avowed that

if the choice of secession by the states were left up to him, he would "unquestionably have favored the continuation of the Union" (Patrick 1944, 246). He also made enemies while on that committee because he was in charge of a board that was responsible for the forced retirements of several officers, some of whom were now in the Confederate Navy. Finally, after pressure from Davis, on 4 March 1861, Congress confirmed Stephen Mallory as the first and only Secretary of the Confederate Navy, and the Confederate Navy was born.

Stephen Mallory's first order of business was to design and man his department. As with other aspects of the Confederate government, Mallory patterned his department on a familiar model, the U.S. Navy Department. In the 1850s, Mallory was a Senator in the U.S. Senate; in 1853, he became Chairman of the Senate Naval Affairs Committee. In this capacity, he was an active backer of the naval shipbuilding modernization program that began in 1854 and was thoroughly familiar with naval affairs and naval developments in Europe (Anderson 1962, 12).

The Confederate Navy had four operational departments. The Office of Ordnance and Hydrography, under Commander John Brooke, was charged with providing munitions, nautical instruments, and charts. The Office of Provisions and Clothing, under Commander John De Bree, dealt with food, clothing, and pay. The Office of Medicine and Surgery under Dr. W. A. W. Spotswood supervised health care of the men in the navy. Finally, the Office of Orders and Detail, under Captain Lawrence Rousseau, was responsible for matters relating to personnel (Durkin 1987, 136). In 1862, Mallory developed a fifth department, the Torpedo Bureau, which became the central authority for the development and deployment of "torpedoes" (mines) and other underwater devices.

Unfortunately, there were several aspects of the U.S. Navy Department that Mallory did not imitate.

Two departments the Union Navy Department had that Mallory did not were the Office of Yards and Docks and the Office of Construction, Equipment and Repair. Without these departments, their duties were split between the four offices above, caused overlapping responsibility and confusion, and slowed the overall work of the navy (Luraghi 1996, 14). Another problem Mallory faced was the depth of his staff.

After the appointment of the four department heads, his personal staff was shallow. He had a total of five clerks working for him (Luraghi 1996, 10). Another shortcoming of Mallory's staff was the lack of a chief of staff. Along with building and fighting a navy, Mallory personally drafted all orders and assignments of personnel. In short, he was everything: "administrator and head of the navy, author and executor of naval strategy, and the man responsible for the conduct of maritime and coastal operations" (Luraghi 1996, 14). With this shallow staff, Charles Conrad and the Committee on Naval Affairs forced Mallory to defend his actions to Congress.

Charles Conrad, Congressman from Louisiana, had criticized Mallory from the moment of his nomination as Secretary of the Navy. The attacks grew stronger and more frequent after the fall of New Orleans. In August 1862, Conrad convinced the House of Representatives to appoint a special committee to investigate the administration of the Navy Department. For one and one-half years, Mallory was under scrutiny of the investigating committee. He was required to gather all his records to submit them to the committee, travel to Congress to testify, and write lengthy letters to answer committee member questions, all at a time when the navy needed his leadership on the waterfront.

The Strategy

Jefferson Davis visualized a strategy similar to George Washington's in the American Revolution. Washington traded space for time; he retreated when necessary in the face of a stronger enemy; and he counterattacked against isolated British outposts or detachments when such an attack promised success. This has been called a strategy of attrition, of wearing out a better-equipped enemy and compelling him to give up by prolonging the war and making it too costly (McPherson 1988, 337). Two main factors prevented Davis from carrying out this strategy, except to a limited degree in the war. Both factors stemmed from political and military realities.

The first was a demand by governors, congressmen, and the public for troops to defend every portion of the Confederacy from penetration by Union forces. Therefore in 1861, small Confederate armies were dispersed around "the Confederate perimeter along the Arkansas-Missouri border, at several points on the Gulf and Atlantic coasts, along the Tennessee-Kentucky border, and in the Shenandoah Valley and western Virginia as well as at Manassas" (McPherson 1988, 337). Criticism permeated the South for dispersing manpower so thinly that Union forces were certain to break through somewhere, as they did several times in 1862.

The second factor inhibiting a strategy of attrition was the attitude of the Southern people. Believing they could defeat any number of Yankees, many Southerners scorned the notion of waiting for the Union to attack. "The idea of waiting for blows, instead of inflicting them, is altogether unsuited to the genius of our people," declared the *Richmond Examiner* (*Richmond Examiner, 27* September 1861). An editorial in the *Staunton*

Spectator, stated, "Our Government must, therefore, abandon its present defensive policy, and must carry the war into the enemy's country" (*Staunton Spectator*, 8 Oct 1861).

The Confederates eventually consolidated these various threads of strategic theory and political reality into what Davis called an "offensive- defensive" strategy. This consisted of defending the Southern land by using "interior lines of communication (a Jominian but also common-sense concept) to concentrate dispersed forces against an invading army and, if opportunity offered, to go over to the offensive, even to the extent of invading the North" (McPherson 1988, 338). Another fact that might have been on Davis' mind while formulating his strategy was geography.

The Southern seashore consisted of 3,500 nautical miles of coastline, as long as the whole European coastal perimeter from Hamburg to Genoa, with more than 189 harbors or navigable river mouths to be defended (Luraghi 1996, 61). It contains hundreds of bays, inlets, river mouths, and deltas, but only a few of them deep enough for large vessels to navigate. Of the seven major harbors, Norfolk, Wilmington, Charleston, Savannah, Pensacola, Mobile, and New Orleans, Norfolk and New Orleans were the largest. Of these, New Orleans and Mobile were the busiest. In volume of goods handled, only New York exceeded New Orleans as a seaport (Anderson 1962, 15).

With its long coastline and numerous inlets, the South was vulnerable to attacks from the sea. This fact caused South Carolina shoreline communities to have great concern about the potential threat from the sea. The naval attacker has mobility and the choice of time and place to launch an attack. It was ominous that, from the time of secession, when other states had not yet thought of ramifications, Southerners felt the sea to be dangerous, expecting the greatest threat to come from that direction (Luraghi 1996,

5). All hopes of a peaceful end to the Constitutional crisis that caused seven states from the South to secede were shattered early one morning in Charleston, South Carolina.

On 12 April 1861, the Confederates attacked Fort Sumter. The events leading to this decision are beyond the scope of this research, but the effects of this action started a chain of events that eventually led to war. Three presidential proclamations in the next seven days led both navies down a road that defined their strategies. As both Davis and Lincoln contemplated their respective options, they issued a series of presidential proclamations. On April 15th President Lincoln called for 75,000 volunteers to end an insurrection by several Southern states. On April 17th President Davis, proclaiming the inevitable invasion of the South, answered by calling for volunteers to take letters of marque to capture Northern merchants, a revival of privateers. Then in Lincoln's final counter, on 19 April 1861, he proclaimed:

> Now, therefore, I, Abraham Lincoln, President of the United States, with a view to the same purposes before mentioned, and to the protection of public peace and the lives and property of quiet and orderly citizens pursuing their lawful occupations until Congress shall have assembled and deliberated on the said unlawful proceedings or until the same shall have ceased, have further deemed it advisable to set on foot a blockade of the ports within the States aforesaid. (Lincoln, 1861, 233-234)

It was the practice of the tie not to include the Secretary of the Navy in discussions concerning presidential proclamations. Neither Mallory nor Gideon Welles, U.S. Navy Secretary, participated in the decisions. Although the Southern attempt to launch privateers failed, the initial Northern blockade proclamation generated developments of enormous importance, far beyond the expectations of their initiators (Luraghi 1996, 63).

The presidential proclamations that set the strategy for the navies on both sides in the Civil War were political in nature. Nevertheless, there was "little choice for either Navy in what it should contribute to the war effort; how it was done was another matter" (Anderson 1962, 288). Mallory observed that Lincoln's blockade proclamation contained the essence of the enemy's naval strategy. Knowing the Northern naval strategy coupled with Davis' defensive strategy for the overall war plan, he knew the essence of his strategy. He had to answer with, "albeit certainly not by means of the blunt and obsolete weapon of privateering" (Luraghi 1996, 63).

The first major problem Mallory faced when setting his strategy in motion was the scarcity of military industries in the South. The mobilization of the workforce in the South to produce equipment for the war effort was also a big concern. Quickly, the shortage of workers for naval needs became even more serious than the shortage of sailors. This shortage of skilled workmen made it impossible to try to imitate the North, which planned to use eleven thousand men for naval construction (Luraghi 1996, 63). In the entire South, there were only three shipyards, the Navy Yard at Norfolk, another naval repair yard at Pensacola, and private shipbuilding facilities at New Orleans (Anderson 1962, 16).

Less than two months after Mallory's appointment to Davis' Cabinet, he sent his first report. This report outlined Mallory's naval strategy concept. This report showed Mallory understood the revolution in technology that was taking place in naval warfare. He wrote the United States "had built a navy: we have a navy to build: and if in the construction of the several classes of ships we shall keep constantly in view the qualities of those ships which they may be called to encounter we shall have wisely provided for

our naval success. I propose to adopt a class of vessels hitherto unknown to naval service" (ORN Ser. 2 1921, 2:51).

Mallory obviously decided he was going to use technological advances to build certain ship types for specific missions. He provided philosophical insights gleaned while Chairman of the Naval Affairs Committee in the U.S. Senate. He added six screw propeller steam frigates and twelve first and second class sloops, the most modern warships in the world to the United States fleet. He also pushed for the construction of an armored ship for the defense of New York Harbor (Luraghi 1996, 5). His effort in the U.S. Senate failed, but gives a peek into his plans for the South.

Mallory's report offers the first proposal: "Vessels built exclusively for ocean speed, at a low cost, with a battery of one or two accurate guns of long range, with an ability to keep the sea upon a long cruise and to engage or to avoid an enemy at will." Mallory was actively seeking "steam vessels which can be most advantageously employed against commerce" (ORN Ser. 2 1921, 2:51). He went on to explain the Confederacy was already arming the two auxiliary cruisers the *Sumter* and the *McRae*. Not exactly what Mallory wanted, but sufficient until proper cruisers could be obtained from overseas (Luraghi 1996, 65). Before submitting this report, Mallory was trying to prepare the two auxiliary ships for cruiser warfare. In addition, Commander James D. Bulloch was sent to Europe to purchase or have built several fast steam cruisers, "which offers the greatest chances of success against the enemy's commerce" (ORN Ser. 2 1921, 2:64). Modern commerce-destroying warfare with steam engines, propellers, and heavy-rifled guns was about to appear for the first time in history (Luraghi 1996, 66).

In a letter to the Committee of Naval Affairs, Mallory outlines the second part of his strategy:

> I regard the possession of an iron-armored ship as a matter of the first necessity. Such a vessel at this time could traverse the entire coast of the United States, prevent all blockades, and encounter, with a fair prospect of success, their entire Navy. If to cope with them upon the sea we follow their example and build wooden ships, we shall have to construct several at one time; for one or two ships would fall an easy prey to her comparatively numerous steam frigates. But inequality of numbers may be compensated by invulnerability; and thus not only does economy but naval success dictate the wisdom and expediency of fighting with iron against wood, without regard to first cost. (ORN Ser 2 1921, 2:67)

From the two correspondences from Mallory, the first phase of his naval strategy is clear: fast, maneuverable steam cruisers for commerce raiding together with armored ships would enable the Confederates to overcome the numerical advantage of the North.

One other aspect to the Confederate naval strategy needs discussion. In the beginning, Mallory underestimated the importance of coastal defense. He envisioned commerce raiding on the high seas to draw blockading ships out to sea to protect merchant vessels. He saw invincible ironclads crushing the remainder of the blockade's wooden ships, as well as sailing the ironclads to Northern harbors to deliver a decisive and devastating blow. However, it was not until initial prodding by people, such as Matthew Fontaine Maury, and later the Union's adoption of amphibious warfare, did Mallory take a hard look at defending the South's vast coastline. In June of 1861, Mallory created the Bureau for the Defense of Coastal Waters and Rivers headed by M. F. Maury. By July 1861, torpedoes were in defense of coastal harbors. Varieties of mines were designed, constructed, and used extensively in the Southern rivers and harbor entrances throughout the war. The Union Navy had adopted a respect for mines, and suffered losses from them. Seven ironclads and about twenty wooden gunboats and

transports were sunk or destroyed by torpedoes. Another weapon of submarine warfare called the *Hunley* became the first submarine to sink an enemy ship in battle.

CHAPTER THREE

THE CONFEDERATE IRONCLAD

> I submit for your consideration the attack of New York by the *Virginia*. Can the *Virginia* steam to New York and attack and burn the city? She can, I doubt not, pass Old Point safely, and, in good weather and a smooth sea, could doubtless go to New York. Once in the bay, she could shell and burn the city and the shipping. Such an event would eclipse all the glories of the combats of the sea, would place every man in it preeminently high, and would strike a blow from which the enemy could never recover. Peace would inevitably follow. (ORN Ser 1, 7:780-781)

Secretary Mallory believed that if the South was to be victorious, they had to counter the overwhelming Union Navy with a smaller but technologically superior force. To this end, he invested the fate of the Confederate Navy in the ironclad. The Confederates did not invent the use of iron or steel armor on ships, as other technologies used by the South. The ironclad, in fact, was one of the first outgrowths of the industrial revolution, with both the railroad and the telegraph (MacBride 1962, 1).

Three factors led to the birth of the ironclad. First was the advent of the steam engine. In 1819, the *Savannah* became the first ship to cross the Atlantic under motor power. The second factor was the availability of cheap wrought iron, brought about by the growing railroad industry. The first two factors, although important, would not have, by themselves, ushered in the new age of the iron navy without a need for it. The ultimate factor was the development of the heavy naval gun, in particular, the shell gun (MacBride 1962, 2).

Once the shell gun became widely used, it did not take long to realize the necessity of armored plating on warships. In 1853, the Turkish Navy destroyed the Russian Navy with their shell guns in the battle of Sinope. This led both the French and

the English to experiment with iron plated batteries in the Crimean War. The problem with these types of ships was balancing the compromises between protection, firepower, speed, and seaworthiness. By 1859, the French designed and built the ship the *Gloire* which solved the problems that had been hindering the development of the ironclad. The English, for the most part, imitated the French design and in 1860 launched the *Warrior* (Luraghi, 1996, 90).

By the beginning of the Civil War, the two major sea powers of Europe were well on their way to having an advanced ironclad fleet. The compromise (armor, speed, armament, seaworthiness) that was adopted for these ironclads was to build basically conventional steam driven frigates with their armament and sailing rig the same and with the application of armor plating on the sides. The American's version, both North and South, was a complete break with naval tradition. In fact, the Union and Confederate ironclads were weapons as foreign to Americans in 1861 as intercontinental missiles were to Americans in 1961 (MacBride 1962, 6). The Americans (North and South), however, did not enter the ironclad ship building industry, albeit for different reasons, as their initial courses of action in preparations for the war.

The reasons the United States lagged behind Europe, as well as the Confederates, in their construction of ironclads were twofold. First, due to a failed attempt by naval contractor Robert Livingston Stevens to produce an ironclad pursuant to an 1842 congressional grant of $250,000 the U.S. Navy of 1850s was not ready to commit its resources to a project that failed (Luraghi 1996, 91). Secondly, the U.S. Navy, well steeped in naval tradition, frowned upon the idea of changing. In the 1840s, after Steven's unsuccessful attempt, Mallory, then in the U.S. Navy, pushed hard for the

continuing development and adoption of the ironclad. His attempt, which met with a very strong attitude of distrust for this new type of warship, was ultimately defeated. Even after the war began, the Union did not seriously begin to think about constructing an ironclad until reports started filtering into Washington concerning the conversion of the *USS Merrimack* at Norfolk Naval Shipyard, to an armorclad warship by the Confederates.

The Confederates, with Secretary Mallory at the helm, did not hesitate to adopt the ironclad as the mainstay of its navy, as well as the cornerstone of its strategy. He was counting on a of lack of initiative by the Union naval officers toward ironclads, that same attitude he fought in the United States Navy in the 1840s and 1850s. However, after an initial inquiry on the availability of wrought iron in the South, he realized to produce a fleet of armored ships, he would have to purchase them from Europe. It was not until many months were wasted abroad, trying to buy or to have ironclads built, did Mallory finally realized that to produce a war machine that "would strike a blow from which the enemy could never recover." He would have to build it in the South and with resources his Navy had available.

The Strategy

Most historians have assumed that the strategy of the Confederate Navy was to break the blockade, and the ironclad was built for this sole purpose. This belief, at least at the beginning of the war, is true. Mallory definitely believed that if he could possess one or more ironclads they "could traverse the entire coast of the United States, prevent

all blockades" (ORN Ser. 2 1921, 2:67). The Confederate Navy did make ironclads; however, they had a totally different mission, coastal defense (Still 1961, 330).

Mallory concentrated his time, between May and July 1861, and two million Confederate dollars trying to buy ironclads from England then France. However, due to unexpected delays in currency allotted by Congress and several other obstacles that a "belligerent" nation comes across when trying to buy arms from "neutral" nations it became clear the Confederate officers sent to Europe would not be able to purchase a pre-built ship (Luraghi 1996, 92-93). Although the hopes of outright buying the ironclads were gone, contracts to have several built were eventually signed with France and England. With some European built ships, Mallory planned to break the blockade and take the naval fight north to Union waters. It was the failure to buy ready-built ironclads in Europe that forced Mallory to try something his contemporaries told him could not be done, build an ironclad at home (Still 1961, 331).

However, the future of the ironclad was not written off the coast of Europe where the first ironclads were built, but off the coast of Virginia. This is where the most celebrated naval battles of the Civil War took place. The converted Union frigate *CSS Virginia* would meet the Union ironclad *USS Monitor*. The stage was set for this naval battle in April 1861, when the Confederates captured the U.S. Naval Yard at Norfolk, Virginia. Among the scuttled vessels at the shipyard was the steam frigate *Merrimack* which the Confederates surprised were able to raise, to their surprise. The hull was intact and the engines, though damaged, were usable (Fowler 1990, 80).

The Virginia militia seized the Gosport Navy Yard, near Norfolk, on 21 April 1861 following the bombardment of Fort Sumter and Lincoln's call for 75,000 men to

quell the Southern "rebellion." In addition to the ordnance and powder supply, there was a drydock that the Union Navy mined but failed to destroy, about half of the buildings and offices, and the wreck of the modern steam frigate *Merrimack*. She displaced 3,200 tons, was 230 feet long, could obtain speeds of over eleven knots, and could carry forty guns (ORN Ser 2, 1:141).

The *Merrimack* Conversion

Although the *Merrimack* was once the most powerful ship of the old navy, she was retired in February 1860 to have her engines overhauled. When the Union Navy abandoned the shipyard, they set her ablaze and scuttled it. Because of that, the water saved her hull from the flames. The Confederates raised her and put her in the drydock on 30 May at a cost of $6,000 (Scharf 1887, 43).

About the same time of the raising of the *Merrimack* in Norfolk, Commander John Mercer Brooke, inventor of the Brooke rifled gun (see figure 1), met with Mallory and showed him a plan to build an ironclad. Mallory liked the design and sent for naval constructor John Luke Porter and Chief Engineer William P. Williamson to assist in drawing up the plan. Porter and Williamson arrived with their own plan for an ironclad. Both designs had a rectangular casemate with slanted sides and holes for guns on all four sides. Brooke's plan produced the long, tapering hull with an iron ram on the bow (MacBride 1962, 78).

All three men knew the urgency of their work, and one day after their meeting with Mallory, Brooke and Williamson began looking for the two primary components required to build the ironclad, engines and armor. Because of the South's poor industrial

base, this task was not an easy one, their only hope was Tredegar Iron Works in Richmond. Joseph Reid Anderson, the manager of the Tredegar, told them there was no industrial plant in the South capable of making the engines required. Nevertheless, he suggested going to Gosport Navy Yard and using the engines of the steam frigate *Merrimack*. In addition, because it would be hard to adapt them to another ship, they could use the entire hull (Luraghi 1996, 94). Brooke was not happy with the *Merrimack's* displacement, but felt its use would save a great deal of money and time. Mallory accepted the proposal and the three men went to Norfolk to determine if the project was feasible (ORN Ser. 2, 1:784).

On 25 June, Brooke, Porter, and Williamson sent Mallory a report that the *Merrimack* could be converted into an ironclad and carry at least ten heavy guns. The conversion cost was estimated at $110,000, for most of the materials needed were available in the navy yard (ORN Ser 2, 2:174). Mallory immediately set in motion the construction of the South's ultimate weapon and placed Brooke in charge of the conversion. Mallory sent Porter to start the construction work and Williamson to supervise the overhaul and repair of the engines. Brooke remained in Richmond to oversee the production and testing of the armor plates and to buy heavy guns for the new ship (ORN Ser 2, 1:784).

Throughout the construction of the *Virginia*, production problems, shortages in resources, and bureaucracy hampered the completion of the *Virginia*. The one area that went relatively smooth was the preparation of the hull and main deck and the production of the casemate. Porter removed all the burned parts of the ship. He then cut her hull straight from the bow to the stern about three feet above her waterline. Next, he started

on the main deck, once complete he began to raise the casemate framework (Scharf 1887, 152). In testing the armor for the casemate, several tests were conducted using setups of different configurations of iron. As Brooke obtained samples, he began to test them on Jamestown Island where his friend and expert artillery officer Catesby ap R. Jones commanded the coastal batteries. The samples tested were 3, 1-inch thick iron plates stacked on each other and mounted on a thick wooden plank. They used one-inch rolled plates because neither Tredegar nor any other factory in the South could not roll iron thicker than one inch. The samples tested failed miserably. An eight-inch bolt fired from three hundred yards pierced all three plates of iron and penetrated five inches into the solid oak planking (ORN Ser 2, 1:785-786). The solution, Tredegar had to retool the factory to manufacture two-inch thick plates. Nevertheless, once the factory refit was complete, the tests were satisfactory. Two superimposed layers of two-inch plates would protect the ship (Luraghi 1996, 97).

The next problem to arise for Brooke was that of raw material. Tredegar used up its available iron stock. The Confederate solution, to disassemble some railroad lines in order to use the rails for rolling out the plates, proved disastrous in the end. Still needing more iron, Brooke appealed to the commander of the Norfolk Navy Yard to send as much scrap iron as he could to Richmond. With this, the plates were ready and by 12 February 1862, Tredegar completed the task (see Figure 2), 723 tons in all, at a cost of $123,715 (Luraghi 1996, 97).

While production of the plates was ongoing, Brooke began the search for guns. Catesby ap R. Jones, who worked with Commodore Dahlgren in the U.S. Navy, recommended using the big ten-inch Dahlgren smoothbores. However, Tredegar was

already producing fifty nine-inch pieces of this category for the Navy. Ultimately, Brooke decided to use three of these on each side on the ironclad. As for the forward and aft heavy guns, Mallory intended to have the ship fitted with the most modern rifled guns capable of firing either shells or armor-piercing bolts. This would be a part of his technological surprise for the enemy (ORN Ser 2, 2:174-175). Brooke designed and Tredegar built the most modern gun in the world that proved superior to any enemy naval gun and to almost any in Europe, to rank "among the most powerful muzzle-loading rifled guns ever built" (Luraghi 1996, 98).

The two models used were a 7-inch and a 6.4-inch. They used a special kind of cast iron characterized as rich in iron and poor in graphite. This type of cast iron had exceptional resilience and tensile strength. To help reinforce the gun breach, six heavy iron bands, two inches thick and six inches wide, were welded together and mounted on the breach. It could fire larger charges without the danger of bursting the breach. To avoid the risk of an explosion in the muzzle, Brooke invented special rifling with seven grooves. The grooves were not hollow and raised as ordinary, but made in the shape of oval-shaped bends ending in a tooth from which came the next bend. These gave the muzzle of the gun a design similar to a saw-wheel--called the Brooke rifling system. Brooke then designed a special shell that had cogs at its bottom that corresponded to the rifling of the gun. A sabot of bronze or copper was then placed over the cogs, which ensured the fitting of the projectile into the elliptical grooves. The result was a reduction in vibration as the shell traveled through the bore. This vibration was the leading cause of muzzle explosions in the heavy guns (Luraghi 1996, 98).

The other potential problem that could end the conversion was Williamson's task of preparing the engines for operation. The engines were in such poor shape that the U.S. Navy condemned them before the war. Fortunately for Williamson, his assistant was H. Ashton Ramsay, who had served as an engineer on the *Merrimack* before the war. The two repaired and overhauled the engines almost piece by piece. After the engines were complete, the *Virginia* was ready to launch (Ramsay 1907, 310).

When finally launched, 17 February 1862, a serious error was discovered. Instead of the casemate extending two feet below the water, which is what Brooke's plan calls for, the decks were barely awash. To help alleviate this potentially deadly mistake, hundreds of tons of iron was stowed in unused storerooms. This, plus the 150 tons of coal and other supplies only brought her eaves down six inches below the water. Lieutenant Catesby ap R. Jones, named the Virginia's executive officer, wrote a letter to Brooke on 5 March 1862 that Brooke published after the war in an article for the *Southern Historical Society Papers*. Jones states:

> The ship will be too light, or I should say, she is not sufficiently protected below the water. Our draft will be a foot less than was first intended, yet I was this morning ordered not to put any more ballast in fear of the bottom. The eaves of the roof will not be more than six inches immersed, which in smooth water would not be enough; a slight ripple would leave it bare except the one-inch iron that extends some feet below. We are least protected where we most need it. The constructor should have put on six inches where we now have one. (Brooke 1891, 31)

Therefore, like many "experimental" vessels, she had weaknesses. However, her most serious shortcoming was the power plant. The engines were what caused the old *Merrimack* to be sent to the navy yard in the first place. With all the added tonnage, the

Virginia could only achieve eight knots in very calm water (generally ran at six knots). The steerage was so bad it took thirty minutes to turn 180 degrees (Still 1971, 25).

Reports in the North of the conversion of the *USS Merrimack* to the *CSS Virginia* set into motion the development and construction of the first monitor-type ironclad. Secretary of the United States Navy Gideon Welles decided to ask Congress to authorize the appointment of a board of naval officers to study the feasibility of ironclads. After congressional authority, Welles created the board. By this point in August of 1861, the work of converting the *Merrimack* was well on its way in Norfolk.

The board accepted a plan from John Ericsson, an inventor who worked on the design of an ironclad for ten years. The contract was set at $275,000. It required the delivery of the vessel on time, it was to be a complete success, or he must return the advanced money. By the time this contract was signed in October 1861, Ericsson had already started to work mobilizing shops throughout the Union. One built the turret, one built the engines, and another rolled the iron plates while a shipyard started on the hull. The vessel was launched 30 January 1862, just one hundred days work was begun and turned over to the Navy in February of 1862. Ericsson's specifications were so exact that components manufactured simultaneously hundreds of miles apart fit together with little or no alteration needed (Luraghi 1996, 113).

After its release to the Union Navy on 19 February 1862, the *Monitor* sailed to the Brooklyn Naval Yard where she encountered countless problems. Of these problems, the steering, or lack of, was the most serious. Ericsson had to go onboard on 2 March to provide a "quick fix" to the steering system so the *Monitor* could start her journey south. After all final corrections, she was towed to Hampton Roads (Fowler 1990, 84). Due to a

storm in the Atlantic, the *Monitor* arrived too late to help the wooden vessels of the Union Navy.

The night before the engagement the *Virginia* was having problems of her own. Her officers were still trying desperately to secure enough powder for her guns. "If it did not come, she could still meet her appointment well enough, but her guns would be mute. In the greatest naval drama of the century, in the test for which she was destined from birth, without that powder she would be silent" (Davis 1975, 2). However, after delays in supplies and those caused by the weather, the *Virginia* got underway.

The events that followed shaped the future of naval warfare. The battles were scrutinized not only by the Union and by Confederates, but also across the seas by England, France and the entire world. Accounts of the battles that took place 8 and 9 March 1862 through the reports and letters from both Confederate and Union sailors and soldiers will be given in figure 3.

The first is the words of Admiral Franklin Buchanan, Confederate States Navy, in his after-action report written while in Naval Hospital, Norfolk, Virginia, 27 March 1862, to the Secretary of the Confederate Navy:

> Having been confined to my bed in this building since the 9th instant, in consequence of a wound received in the action of the previous day ... the official report, which I now have the honor to submit, of the proceedings on the 8th an. 9th instant of the James River squadron, under my command, composed of the following-named vessels: Steamer *Virginia*, flagship, ten guns; steamer *Patrick Henry*, Commander John R. Tucker, twelve guns; steamer *Jamestown*, Lieut. Commanding J. N. Barney, two guns; and gunboats *Teazer*, lieut. commanding W.A. Webb; *Beaufort*, Lieut. Commanding W.H. Parker; and *Raleigh*, Lieut. Commanding J.W. Alexander, each one gun. Total, twenty-seven guns.
>
> On the 8th instant, at 11 a.m., the *Virginia* left the navy yard (Norfolk), accompanied by the *Raleigh* and *Beaufort*, and proceeded to Newport News, to engage the enemy's frigates *Cumberland* and *Congress*, gunboats, and shore batteries.... The *Virginia* stood rapidly on toward the *Cumberland*, which ship I

had determined to sink with our prow if possible. In about fifteen minutes after the action commenced we ran into her on her starboard bow. The crash below the water was distinctly heard, and she commenced sinking....

Having sunk the *Cumberland*, I turned our attention to the *Congress*. We were some time in getting our proper position in consequence of the shoalness of the water and the great difficulty of managing the ship when in or near the mud.... During all the time her keel was in the mud; of course she moved but slowly ... the Virginia was thus engaged in getting her position for attacking the *Congress* .... The carnage, havoc, and dismay caused by our fire compelled them to haul down their colors and to hoist a white flag at their gaff and half-mast and another at the main.... While the *Beaufort* and *Raleigh* were alongside the *Congress*, and the surrender of that vessel had been received from the commander ... a heavy fire was opened upon them from the shore and from the *Congress*, killing some valuable officers and men.... On witnessing this vile treachery I instantly recalled the boat and ordered the *Congress* destroyed by hot shot and incendiary shell. About this period I was disabled, and transferred the command of the ship to that gallant, intelligent officer Lieut. Catesby Jones, with orders to fight her as long as the men could stand to their guns.

The *Minnesota* grounded in the north channel, where, unfortunately, the shoalness of the channel prevented our near approach. We continued, however, to fire upon her until the pilots declared it was no longer safe to remain in that position, and we accordingly returned by the south channel ... again had an opportunity of opening upon the *Minnesota*, receiving her heavy fire in return... It had by this time become dark and we soon after anchored off Sewell's Point.

The *Congress*, having been set on fire by our hot shot and incendiary shell, continued to burn, her loaded guns being successively discharged as the flames reached them, until a few minutes past midnight, when her magazine exploded with a tremendous report.

At an early hour next morning (the 9th), upon the urgent solicitations of the surgeons, Lieutenant Minor and myself were very reluctantly taken on shore.... The following is an extract from the report of Lieutenant Jones of the proceedings of the *Virginia* on the 9th:

At daylight on the 9th we saw that the *Minnesota* was still ashore, and that there was an iron battery near her. At 8 [o'clock] we ran down to engage them... firing at the *Minnesota* and occasionally at the iron battery.... The great length and draught of the ship rendered it exceedingly difficult to work her. We ran ashore ... and were backing fifteen minutes before we got off ... engaged the *Monitor*, and sometimes at very close quarters. We once succeeded in running into her, and twice silenced her fire. The pilots declaring that we could get no nearer the *Minnesota*, and believing her to be entirely disabled, and the *Monitor* having run into shoal water, which prevented our doing her any further injury, we ceased firing at 12 o'clock I and proceeded to Norfolk....

The stem is twisted and the ship leaks. We have lost the prow, starboard anchor, and all the boats. The armor is somewhat damaged; the steam-pipe and smoke-stack both riddled; the muzzles of two of the guns shot away.... The

bearing of the men was all that could be desired.... They were strangers to each other and to the officers, and had but a few days instruction in the management of the great guns. To the skill and example of the officers is this result in no small degree attributable.
Very respectfully, Franklin Buchanan. (ORN Ser. I, 7:44-49)

The next report comes from Gideon Wells, United States Secretary of the Navy, on the Operations in Hampton Roads. Report dated 15 March 1862:

> Sir: The naval action which took place on the 10th [9th] instant between the *Monitor* and the *Merrimack* at Hampton Roads, when your vessel with two guns engaged a powerful armored steamer of at least eight guns, and after a four hours' conflict repelled her formidable antagonist, has excited general admiration and received the applause of the whole country.
>
> The President directs me, while earnestly and deeply sympathizing with you in the injuries which you have sustained, but which it is believed are but temporary, to thank you and your command for the heroism you have displayed and the great service you have rendered.
>
> The action of the 10th [9th], and the performance, power, and capabilities of the *Monitor*, must effect a radical change in naval warfare.
>
> Flag.Officer Goldsborough, in your absence, will be furnished by the Department with a copy of this letter of thanks, and instructed to cause it to be read to the officers and crew of the *Monitor*.
>
> I am, respectfully, your obedient servant, GIDEON WELLES. (ORN Ser. I, 7:38-39)

The battle between the *Virginia* and *Monitor* has been the subject of much debate. As evident by the two above reports, both sides have claimed the victory. The honors of the day could be technically awarded the *Monitor* in lieu of the *Virginia's* leaving for Norfolk, and the *Monitor* remained in the area and saved the *Minnesota*. However, according to the Confederates, the *Monitor* ran to shallow waters and refused to re-engage the *Virginia*. In fact, the *Monitor's* designer John Ericsson relayed the same sentiment in a postwar letter stating, "No one knows better than yourself the shortcomings of that fight, ended at the moment the crew had become well trained; and the machinery got in good working order. Why? Because you had a miserable executive

officer who, in place of jumping into the pilot house when Worden was blinded, ran away with his impregnable vessel" (Ericsson 1874). With both navies rejoicing in their victories over the other, it takes a Confederate Army officer to put the first battle of the iroclads into perspective. The following is a report made 10 March 1862 from Major General Benjamin Huger, C.S. Army, Commanding Department of Norfolk concerning the Battle of the *Monitor* and Virginia:

> I telegraphed yesterday to the Secretary of War the fact of the naval engagement on the 8th and 9th instant. As the battle was fought by the Navy, Flag-Officer Forrest will no doubt report to the Navy Department the result of the engagement.
>
> The two sailing vessels (*Cumberland* and *Congress*) were destroyed-the first sunk and the other burned by the *Virginia*-and on the 9th the *Minnesota*, still aground, would probably have been destroyed but for the iron-clad battery of the enemy called, I think, the *Monitor*. The *Virginia* and this battery were in actual contact, without inflicting serious injury on either.
>
> At 2 p.m. on yesterday, the 9th, all our vessels came up to the navy-yard for repairs. The *Virginia*, I understand, has gone into dock for repairs, which will be made at once. This action shows the power and endurance of iron-clad vessels; cannon-shot do not harm them, and they can pass batteries or destroy large ships. A vessel like the *Virginia* or the *Monitor*, with her two guns, can pass any of our batteries with impunity. The only means of stopping them is by vessels of the same kind. The *Virginia*, being the most powerful, can stop the *Monitor*; but a more powerful one would run her down or ashore. As the enemy can build such boats faster than we, they could, when so prepared, overcome any place accessible by water. How these powerful machines are to be stopped is a problem I cannot solve. At present, in the *Virginia*, we have the advantage; but we cannot tell how long this may last.
>
> I remain, very respectfully, your obedient servant,
> BENJ. HUGER, Major-General, Commanding. (ORN Ser. I, 7:54-55)

The New Strategy

During the conversion of *Merrimack*, five other ironclads were started from the keel up: *Georgia, Louisiana, Mississippi,* and sisters *Arkansas* and *Tennessee (I)*. With the exception of *Georgia,* the designs of these vessels reflected the offensive policy

endorsed by Mallory requiring ironclads to operate on the high seas and attack Union blockaders. Although their designs varied, all shared common characteristics of a heavy armament of ten or more guns, exceedingly large dimensions, and unorthodox means of propulsion (Still 1997, 53).

During this time, Mallory was also confronted with another problem, having to provide the defense of the harbors and rivers in the Confederacy. In the fall of 1861, the Union Army and Navy began a new strategy, conducting amphibious operations along the confederate Atlantic coastline. These operations renewed public fear and in turn put pressure on state and central governments to strengthen the coastal defense. These pressures were being applied at the same time Confederate generals were demanding more troops released to operate in the field. Therefore, the Confederate Navy assumed the major part of the responsibility defending the Southern coast (Still 1961, 331-332).

The Confederate Navy, to meet this responsibility, had to build more warships. Not large seagoing steamers, but small, shallow draft ships to operate in the shallow waters of the Southern harbors and rivers. With the perceived victory of the *Virginia* in Newport News, and its deterrent presence for over a month afterwards in mind, Mallory devised his second ironclad strategy; to defend all Southern harbors with a squadron of homemade ironclads that would operate as "movable forts" with batteries capable of destroying any Union ironclads (table 1). The second part of this new strategy was still to buy oceangoing ironclads from Europe for the offensive attack on Union forces. To implement this new naval strategy Mallory could not use the shipyards of the past, exposed to Union attacks, but had to spread out the ship building throughout the South, and farther inland (figure 4) (Luraghi 1996, 190).

In the fall of 1862, the Confederacy created the Office of Chief Constructor and appointed John Luke Porter to the position and in doing so made him responsible for Confederate shipbuilding (Luraghi 1996, 36). Porter was responsible for designing and drawing the specifications for naval ships, including ironclads. These plans, forwarded to shipbuilders throughout the South, were followed, but due to the lack of facilities, material and workers, modifications were necessary on many of the ships. There were some exceptions to this general statement. Like the *Virginia*, the *Atlanta, Baltic*, and the *Manassas* were converted from wooden steamers and did not follow prearranged design (Still 1961, 333).

The two major problems the Confederate ironclad program had to overcome were the production of iron plates and steam engines. Unfortunately, there were only three companies in the South that could produce iron plating thick enough to armor ironclad ships. They were Tredegar Iron Works in Richmond, Atlanta Rolling Mill, and the Shelby Iron Company in Alabama. Even these three companies could only do so much. They all lacked workmen and materials (Luraghi 1996, 42).

Tredegar was one of the best metallurgical factories in America, although it was not on the same scale as those found in Pennsylvania and New York. Tredegar produced heavy pieces like: armor plates; guns; boilers and engines for ships; land and sea torpedoes; gun carriages; and railroad cars, rails, and locomotives (Luraghi 1996, 41). Tredegar's problem in production was not a lack in workman, but a critical shortage of material as illustrated in the above paragraphs on the conversion of the *Merrimack*.

The second company that equipped itself to roll iron plates for the Navy was Schofield and Markham, of Atlanta, Georgia. It became known as the Atlanta Rolling

Mill and was taken under complete control by the Navy. This Mill rolled the armor plates for the ironclad *Mississippi.* On 7 August 1862, Commander George Minor stated that the mill had produced ten thousand tons of plate (ORN Ser. 2, 2:248).

The third and last rolling mill was not in operation until 1863. It was the Shelby Iron Company of Columbiana, Alabama. Created by an association between foundrymen and iron mine owners, Shelby became one of the most promising industries of the South. The Confederate government signed a contract that guaranteed twelve thousand pounds wrought iron per year for three years. Shelby however never reached this amount (Luraghi 1996, 41).

The Relationship between Shelby and the Confederates became strained. The company was trying to fill orders from many sources. While producing armor for warships built in Alabama and on the Mississippi River, it was trying to fill orders from the army. The problem was not a lack of facilities or, in some cases, material but that of skilled laborers. The director of Shelby, A. T. Jones felt if he had adequate skilled laborers, the factory could produce forty tons of plate per day. Shelby did, however, manage to provide some assistance to the Navy, from it came armor plates for many ironclads, among them the famed *Tennessee II* (Luraghi 1996, 42).

The next major obstruction to the building of ironclads the Confederates had to overcome was the availability of adequate propulsion systems. In 1862, Mallory wrote to President Davis, "No marine engines such as are required for the ordinary class of sloops of war or frigates have ever been made in any of the Confederate States, nor have workshops capable of producing them existed in either of them. Parts of three such

engines only have been made in Virginia, but the heavier portions of them were constructed in Pennsylvania and Maryland" (ORN Ser. 2, 1:149).

Mallory selected, on 21 April 1862, engineer in chief William P. Williamson to head this important project. Williamson, from North Carolina and veteran of the U.S. Navy, never achieved successes such as Commander Brooke and his rifled gun but one must consider the numerous adversities he had to face. To compensate for the lack of an industrial base, Williamson tried to obtain steam engines from other sources, buying them from Europe and converting engines from other wooden steamers. Unfortunately for the South, most of the steam engines that were reworked from other ships proved not powerful enough for heavy ironclads and the buying program in Europe did not produce as many engines as expected (Luraghi 1996, 48). Therefore, the Confederacy had to develop an industry that had never before existed in Southern states, the production of powerful marine steam engines.

Although some Southern companies fitted out in haste, succeeded in producing some engines, most marine engines were produced at three factories. Tredegar again came to the rescue, in addition to repairing the engines of some gunboats, it produced those for the ironclad *Richmond* and for three other vessels. The second company, also in Richmond was the Shockoe Manufacturing Company of Richmond (figure 5). Shockoe, contracted in September 1862, built engines and boilers exclusively for the Navy, for both small gunboats and ironclads. The only other facility to build steam engines for the Confederate Navy was Columbus Naval Iron Works in Georgia (figure 6) (Luraghi 1996, 48). Under the command of Chief Engineer James H. Warner, the Columbus Naval Iron Works became the most important manufacturer of marine steam engines in the

Confederacy. In March of 1862, it began producing engines and boilers for several ironclads and other ships. The engines from this company were praised for their quality and reliability (Still 1997, 80-81).

The new defensive strategy required smaller, more maneuverable, shallower draft ironclads to be built in obscure locations. Most of the locations for the new shipbuilding facilities (word facilities used loosely), are not in areas that would normally be associated with this trade. Because these vessels were designed for harbor defense, they were incapable of travelling very far from their homeport. Therefore they were being built in areas the Confederates believed they had a need for protection from the Union fleet. These areas were New Orleans, James River, Charleston, Savannah, North Carolina Sounds, Mobile, and Yazoo River (figure 4). Consequently, in early 1862 the Confederate Navy adopted two basic designs, which became standard models for the ironclads built from then on. The first design chosen was the *Richmond* class. A group of ironclads *(Chicora, North Carolina, Palmetto State, Raleigh, Richmond, Savannah,* and others unfinished) was started in the spring of 1862. The single-screw *Richmond* design had a lower hull and a round bilge. At the waterline, a solid knuckle protruded five feet from the hull and protected that vulnerable area from battle damage. The casemate was similar to the *Virginia's,* but had fewer guns, only four: one pivot-mounted at either end and another on each broadside. The designed dimensions of the *Richmond* class were 150 feet by 34 feet by 14 feet, extreme dimensions were 174 feet by 45 feet. The intended draft was 13 feet, a significant improvement over the *Virginia's* 23 feet (Still 1997, 54).

The second basic design of ironclads was similar to the *Richmond* class. The *Charleston* class *(Charleston, Virginia II* and others unfinished), were designed by naval constructor William A Graves with the dimensions of: 180 feet by 34 feet by 14 feet. The *Tennessee* class *(Tennessee, Columbia,* and *Texas),* were a Porter design with the dimensions of 189 feet by 34 feet by I4 feet. These two classes were a stretched version designed to carry more armament. The 250 foot by 62 foot by 13 foot *Nashville* class *(Nashville* and others unfinished) was a sidewheel version developed by Porter in order to take advantage of the availability of riverboat machinery in the South (Still 1997, 54).

The designs of these "second-generation" *Richmond* class ironclads incorporated changes based on combat and operational experience of the earlier ironclads. Because of the capture of the *Atlanta* in June 1863, many ironclads had an additional two inches of iron plating (for a total of six inches) added to their casemates. This was for protection against the big fifteen-inch Dahlgren smoothbore guns. Those ironclads receiving the extra armor plate had their casemates shortened and often their armaments reduced in order to maintain their designed drafts. Porter also developed two shallow draft versions of the standard *Richmond* hull, the *Milledgeville* and *Wilmington.* They had twelve-foot hulls with a designed draft of nine feet, both were propelled by twin screws. The *Milledgeville* had a short, four-gun casemate covered with six inches of iron, while the *Wilmington* had two short casemates, each containing a single, pivot-mounted Brooke gun. Neither vessel was completed (Still 1997, 55).

The second standard design used for Mallory's new defensive strategy was to be constructed, as stated above, at inland areas far from sources of skilled workers and ship material. These ironclads had simplified hulls, characterized by flat bottoms. They were

lighter than those of other classes of ironclads and did not carry more than four inches of armor. These ironclads were called diamond hull types because of their shape when viewed from the end (figure 7). They were intended for riverine warfare and had shallow drafts between seven and nine feet (Still 1997, 55).

The first diamond hull ironclads to enter the Confederate Navy were the *Huntsville* and *Tuscaloosa*. Both built in Selma, Alabama, between 1862 and 1863, and though accurate data is lacking, they were estimated to be 150 to 170 feet long, to have seven to eight feet drafts, and to have four guns. The small ironclads built in North Carolina, the *Albemarle* class (*Albemarle* and *Neuse*) are considered the basic version of the diamond hull ironclad. This group of small ironclads was designed by Porter to be used in the shallow North Carolina Sounds. The original light-draft, two-gun vessel design, with dimensions of 139 feet by 34 feet by 9 feet, on a 6 foot, 6 inch draft, was altered in the construction of both the *Albernarle* and *Neuse*. Both ironclads exceeded the designed length by 19 feet and draft by about 1 1/2 feet. Porter also designed a lengthened four-gun version of the *Albemarle*. Built at Richmond as the *Fredericksburg*, it measured 188 feet by 40 feet by 11feet, with a 9 1/2 foot draft (Still 1997, 55).

This ironclad design was truly innovative. Its best feature and one which is crucial to any new design implemented while at war, is its simplicity. The conventional hull, built during the Civil War was a curved structure needing countless calculations. The techniques for forming the ribs took a highly trained craftsman. Even a special part of a tree was used in order to give the hull structural strength. The Confederate design broke completely from the conventional wisdom of the day. The hull was flatbottomed and flatsided. This enabled the Confederates to build the ships wherever there was a

supply of timber, even green wood. It was no harder to build these ships than it was to build a house or barn (MacBride 1962, 79).

Robert MacBride author of *Civil War Ironclads,* describes just how simple it was to build these ships:

> The keel was laid and construction commenced by bolting down across the center, a piece of frame timber 8 x 10 inches. Another frame of the same size was then dovetailed into this, extending outwardly at an angle of 45 degrees forming the side, and at the outer end of this, the frame for the shield was also dovetailed, the angle being 35 degrees, and then the top deck was added, and so on around to the other end of the bottom beam. Other beams were then bolted down to the keel and to the first fastened, and so on, working fore and aft, the main deck beams being interposed from stem to stem.
>
> When this part of the work was completed she was a solid boat, built of pine frames, and if caulked would have floated in that condition, but she was afterwards covered with 4-inch planking laid on longitudinally as ships are usually planked and this was properly caulked and pitched, cotton being used for caulking instead of oakum. The iron plating consisted of two courses … the first course was laid lengthwise …, a two inch space, filled with wood being left between each two layers to afford space for bolting the outercourse through the whole shield (casemate) and the outer course was laid flush, forming a smooth surface.
>
> The inner part of the shield was covered with a thin course of planking, nicely dressed, mainly with a view to protection from splinters. Oak knees were bolted in, to act as braces and supports to the shield. The sides were covered from the knuckle (usually) four feet below the deck.. (MacBride 1962, 80)

Since all ironclads built loosely imitated the basic design of the *Virginia,* it gave them all a distinguishable profile from the waterline up (figure 8):

> a raft-like base on which sat a box-like casemate (that portion resting on the deck above the waterline) pierced on port, starboard, fore and aft by gunports and topped by a large iron smokestack. Within the menacing iron hulk was a traditional arrangement of decks: a gun deck at the water line, a berth deck (housing living quarters, galley, storage rooms, the magazine and the engines) under the water line, and a spar deck (also called the shield deck or casemate deck), which was simply the top of the casemate. These vessels, like the original *Virginia,* were armed not only with rifled guns and smoothbores, but also carried iron rams on their bows. All were technically "ironclad steam sloops," or ironclad vessels powered by steam engines and having their guns on a single deck.. (Coski, 1996, 77)

Louisiana Ironclads

New Orleans, the breeding grounds for several upcoming naval innovations, led the rest of the South in the race for producing ironclads. When President Davis and the Confederate Congress authorized the issuance of letters of marque, it spawned the creation of two new naval weapons. One, the *Pioneer*, covered in a later chapter; the second was a privateer named the *Manassas*. A local ship designer and builder, J. O. Curtiss bought and converted a tug named *Enoch Train* to an ironclad. The *Manassas* was a strange looking vessel some called the "turtle back" (MacBride 1962, 126-127). However, her destiny did not include the spoils of bounty as a privateer. As the other two ironclads under construction in New Orleans by the Navy Department ran into delays, Mallory, anxious to have protection in the Mississippi River, seized the private ironclad. Once seized by Lieutenant Warley, *Manassas* has the distinction of being the first ironclad to be in commission and to see action in the Civil War. In October of 1861, she attacked four Union ships stationed on the Mississippi River near New Orleans. She rammed the *USS Richmond* amidships, unfortunately for Warley, the Union ship had a coal barge alongside and the attack caused much more damage to the *Manassas* than to the Union vessel. Her next action was in April of 1862 in which she rammed several Union vessels but had minimal effect and after fighting throughout the night, was finally destroyed by Admiral Farragut's attacking fleet (Still 1971, 50-51).

Two other ironclads, funded by the Confederate Navy, also started construction in New Orleans. However, they were under construction by entrepreneurs from out of state. E. C. Murray from Kentucky sold his idea for an ironclad to Mallory and promised a

delivery date of January 1862. Murray established his shipbuilding facility above New Orleans in Jefferson City on a plot of land loaned to him. His design was unique because the ship, later named the *Louisiana*, had "in-line" paddle wheels, mounted inboard, and two small propellers astern to help with steering (Still 1997, 97).

The two brothers Asa and Nelson Tift from Florida were building the second ironclad, the Mississippi. John L. Porter drew the design that the Tifts were trying to get New Orleans shipbuilders to build. The shipyards were willing to build their ironclad but would not commit to a completion date. So the brothers rented a plot of land adjoining Murray's facility and bought a sawmill (Still 1997, 97). The *Mississippi* had an unusual propulsion system as well. It had sixteen boilers providing steam for three engines that would drive three propellers (Still 1971, 44).

Both projects, hampered from the start from the lack of material and workers, progressed very slowly. The description of the progression of these two ironclads could be used to describe all ironclads construction in the Confederacy. The wooden hull and casemate were built relatively quickly. The designs were simple, any worker that could build a house would be able to frame these vessels. Timber for the frames was also available. Ironclads did not need perfectly aged oak for the hull as a wooden vessel did, so it could use green freshly cut timber that was plentiful in the South (MacBride 1962, 130). The only problem with this is, like all other material, is transportation of the timber to the job site. The condition of the railroad system in the South is beyond the scope of this research. It would be fair to say that transportation of war material in the South was severely hampered by the state of the Confederate railway system. The construction of

the ironclads though, would come to an abrupt halt when ready for mounting the iron plating (MacBride 1962, 130).

Both ironclads vying for this limited material compounded the already dire situation, resulting in the *Louisiana* using inferior T-rails instead of rolled iron plates (Still 1971, 44). The next setback for both ships was their propulsion system. As stated above, they both had unique ways of motive power. These unique systems also turned out to be their demise (MacBride 1962, 131). The *Louisiana* builders did what so many other Southern builders had to do, use existing steam engines from a smaller wooden vessel. The engines, selection based on availability not power or suitability, were not difficult to find.

However, the shaft, which had to be forged, took so long to obtain, the ironclad was launched only days before the Union attack of New Orleans (Still, 1962, 45). After countless delays, the *Louisiana* finally launched without having a completed propulsion system. The paddle wheel arrangement proved to be so bad it could not produce enough power to run against the current of the Mississippi River (MacBride 1962, 129). Therefore, the *Louisiana* had to be towed up river to engage the Union fleet. Although towed to the scene of action, Commander John K. Mitchell, the Confederate Squadron's Commander, refused to put her in battle. Mitchell had ship workers onboard trying to complete the installation of her machinery. By the time Mitchell was comfortable with the *Louisiana's* propulsion, Admiral Farragut had passed the forts protecting New Orleans; therefore, the ship was destroyed by the crew to prevent her from falling into Union hands.

The Tifts had the *Mississippi* engines built at Patterson Iron Works (lowest bidder), which promised the engines with its related machinery in ninety days. Nevertheless, like other factories, Patterson did not have the manpower to complete the job. After pleads to Mallory for help, he received Navy constructor Joseph Pierce and twenty workers. This aid, unfortunately, led to other delays by causing the local workers to go on strike to receive pay equal of the twenty government paid employees. With all the delays the *Mississippi* endured, it was inevitable she would not be completed in time to defend New Orleans from the onslaught of the Union warships steaming toward them (Still 1997, 99).

As the Union fleet moved closer to New Orleans, Mallory obviously became very concerned that the two ironclads would not be ready. Even with his personal intervention by way of money, personnel, and the power of his position, the ironclads of New Orleans could not be finished in time. By the accounts of people familiar with the *Mississippi*, she would have been a very formidable warship. As stated above, all Confederates followed her construction very closely. What became very clear, however, was that the North was also tracing the progress. In fact, Admiral Farragut and the Union fleet believed the only way to ensure victory in New Orleans was to attack before the *Mississippi* was complete (Luraghi 1996, 132).

The *Mississippi* was considered the "only hope" by the South and the object of "irrational terror" by the North whose presence (or lack thereof) would hold the outcome of the upcoming battle. It will never be known what impact the *Mississippi* would have had on the battle of New Orleans, but it is known that the mere threat of her completion changed the operational tempo of the Union forces.

Virginia Ironclads

As soon as the *Virginia* was launched, the Gosport Navy Yard started gearing up to build their second ironclad, the *Richmond*. The prototype of the post-*Virginia* class of ironclads, was to be smaller than the *Virginia* and built from the keel up from the plans drawn by Brooke and Porter (Coski 1996, 78). Like in New Orleans, it became a race between the Confederates trying to complete their ironclad and Union forces moving in to recapture their once held territory. As in New Orleans, the Union forces won the race and within one month, the Confederate Navy lost the two most important shipbuilding complexes in the South. However, in this situation the Confederates were able to float the unfinished ironclad, tow her up river, and complete her at the new naval yard in Rocketts, Virginia, a suburb of Richmond (Still 1997, 101).

Even with the inconvenience of moving the *Richmond* to a new location, her completion was in record time (as ironclads were concerned), commissioned in July 1862. Rocketts was not what most people would consider a shipyard, (figure 5); one officer described it to be nothing more than a shed (Still 1971, 90). The *Richmond* was fitted with four-inch iron plate backed by oak and pine bulwarks twenty-two inches thick. She carried four 7-inch and 6.4-inch Brooke rifles and two 10-pound Brooke smoothbores. Her problems again, were her propulsion system (Luraghi 1996, 208). Her engines, although built at Tredegar, were underpowered and she could not make more than five knots (Luraghi 1996, 48, 208).

By the time General Grant's forces were near Petersburg, in the fall of 1864, two other ironclads were completed in Richmond, the *Fredericksburg* and *Virginia II*, and the

keel was laid for the fourth ironclad, the *Texas*. It was fortunate that there was little activity on the James after the fall of Norfolk until 1864. Due to a total lack of iron, the *Virginia II* and the *Fredericksburg* took more than two years to complete. Once launched, Mallory had a formidable squadron of ironclads protecting the waters around Richmond. For the remainder of 1864, the three ironclads patrolled a twenty-mile stretch of the James protecting Richmond. To provide protection to Grant's army now near the James, the United States arrayed a very impressive squadron; among other ships there were four monitors and the captured ironclad ex-*Atlanta* (Luraghi 1996, 288).

In January 1865, Mallory decided it was time for the James River Squadron to go on the offensive. Due to an unusually high river, the ironclads would have enough water to make it over the obstruction at Trents Reach and to attack the Union naval force, which had withdrawn all but one monitor, the *Onondaga*. The attempt to pass the obstruction came at night and resulted in the *Virginia II* and the *Richmond* running aground. After sunrise, the Union's ironclad made its way toward the two disabled ironclads. However, the *Onondaga* only got off seven rounds from its fifteen-inch rifled gun when the river rose enough for the Confederate ironclads to move into deeper water and more importantly out of range. Two of the seven rounds fired by the Union ironclad struck the *Virginia II* and caused moderate damage. Another attempt to pass the obstruction was planned at full tide but due to damage, the *Virginia* could not proceed and the attack was canceled (Still 1971, 185).

Mallory, upset with the Squadron Commander John K. Mitchell (same officer that was in charge of the New Orleans squadron against Farragut), relieved him of his command of the James River Squadron. Mallory replaced him with Rear Admiral

Raphael Semmes of commerce raiding fame. By this time, however, the opportunity was gone, the Union navy had sent back the ironclads that were absent when Mitchell was to attack. Therefore, the next six weeks were inactive for the James River Squadron and Admiral Semmes final act as its Commander, on 2 April 1865, was to order the burning of the ironclads off the shores of Richmond (Still 1971, 222).

South Carolina Ironclads

Early in 1862, Charleston South Carolina started her ironclad program by laying the keels for the *Palmetto State* and *Chicora*. The situation here looked promising for a quick production time for the ironclad. There was a good local shipbuilding industry and rail system from Charleston to Richmond and Atlanta to get iron plates. However, the Confederates were delayed from the beginning due to not having enough timber. They resorted to cutting down trees in Charleston that were not for shade or ornament (Still 1971, 81). Their next delay was in iron plates. This time the plates were available, but the Army would not release enough cars to transport them. Consequently, it was not until early November 1862 that both ships were operating in the Charleston Squadron (MacBride 1962, 106).

They saw their first action on 31 January 1863 when, in a fog bank, they crossed the bar out of the Charleston Harbor and attacked an unsuspecting Union blockading force. The *Palmetto State* rammed the *Mercedita* and shot a round through her, at the waterline, completely disabling the vessel. Then both Confederate ironclads took the Keystone State, a duel paddle wheel ship, under fire causing one wheel and engine to fail

and several fires. However, the lack of speed of the ironclads allowed the crippled Union vessel to escape.

After the engagement, the two ironclads returned to Charleston and a hero's welcome. Immediately, General Beauregard, in charge of the defense of Charleston, sent out a letter proclaiming the blockade of the harbor had been broken (Still 1971, 124). Nevertheless, for the Confederate sailors, it was a bittersweet victory. They learned the hard way the limitations of their vessels. They were highly criticized for not being able to keep a vessel that had only one paddle wheel operational in range of their Brooke - rifled guns to finish the job. *Chicora's* Engineer James H. Tomb expressed his disappointment of the battle by writing, "They say we raised the blockade, but we all felt we would have rather raised hell and sunk the ships" (ORN Ser. I, 13:622-623).

The attack also had another downside, the Union Navy quickly sent four additional monitors to the blockading squadron at Charleston. Therefore, this became the first and last sortie for the Charleston squadron. Two other ironclads were added to the squadron over the next two years, the *Charleston* and the *Columbia*. The *Charleston* became the flagship and only two weeks after her launch, the *Columbia* ran aground and broke her back (broke the keel). On 18 February 1865, as Union soldiers were occupying the city of Charleston, the three remaining ironclads were blown up, one by one, in the middle of Charleston Harbor to prevent their capture (Still 1972, 219).

Georgia Ironclads

The first ironclad commissioned in Savannah was the *Atlanta*. Asa and Nelson Tift converted her from the English-built blockade-runner *Fingal*. Mallory still had

confidence in the brothers, despite the disastrous outcome of the *Mississippi* in New Orleans. After the usual delays due to iron and workers, she was completed in the summer of 1862. However, Admiral Josiah Tattnall, Commander of the Savannah Squadron and last Commanding Officer of the *Virginia*, soon realized she was not suited for river and harbor defense (Still 1961, 338). Her sixteen-foot draft made navigating in the shallow waters of Savannah nearly impossible (Luraghi, 1996, 213).

Mallory's plan was to use *Atlanta* offensively to break up the blockade at Port Royal, between Savannah Georgia and Charleston South Carolina, much like the Charleston squadron did with the *Palmetto State* and *Chicora* (this was at the time Mallory was developing his new naval strategy of ironclad harbor defense). When trying to execute the plan on 5 January 1863, the *Atlanta* could not get through the obstacles near Fort Jackson (Luraghi 1996, 211). By the time the obstructions were removed by the Army engineers, deserters had warned the North Atlantic Blockading Squadron (NABS) of the upcoming attack so it was cancelled (Still 1971, 133).

The *Atlanta* did not make its offensive sortie until June of 1863, during which time the Union's NABS was reenforced with two monitor class ironclads. The *Atlanta* was fitted with a spar torpedo (see chapter 4) and the plan was to take one of the monitors out of action with the torpedo then engage the other in close quarter battle with her Brooke-rifled guns. On the 16 June 1863, the *Atlanta* reached the Warsaw Sounds and met the Union forces. At that moment, the *Atlanta* ran solidly aground which caused her to list to one side, making it impossible to use her guns. Union ironclads, *Weehawken* and *Nahant* moved within 300 yards and began firing. After a few minutes of target

practice for the fifteen-inch Dahlgrens, the Confederates surrendered (Luraghi 1996, 215). Fortunately, the *Georgia* was launched and Savannah remained defended.

The *Georgia* was a huge ship, 250 feet long and armed with seven guns. She turned out to be worthless as a warship due to, what else, her engines. She could not make enough power to move her massive tonnage in calm water. She was turned into a floating battery and towed to the scene of action (MacBrice 1962, 112). After the capture of the *Atlanta*, the Confederates were in a panic. Constructor Henry Willinck of Savannah contracted with Mallory to build another ironclad, the *Savannah*. Launched in February 1863, and after sea trials, the *Savannah* was commissioned 30 June 1863 (figure 9). One of her engines, built at the new Naval Iron Works in Columbus, had a catastrophic failure and had to be shipped back to Georgia for repairs. Chief Engineer Warner, at the Naval Iron Works, was able to effect repairs on the engine and returned to the *Savannah* in fifteen days. With all problems repaired, the *Savannah* was one of the best ironclads built in the South (Luraghi 1996, 280). After the completion of the *Savannah*, Willinck began work on his second ironclad the *Milledgeville*.

On 20 December, as Sherman's Army was marching into Savannah, Admiral Tattnall gave the order to destroy the floating battery *Georgia* and the unfinished *Milledgeville*. The *Savannah* moved upriver and shelled Sherman's rear area firing through the night until she ran out of ammunition. On 21 December, she was set ablaze by her crew (MacBride 1962, 116).

North Carolina Ironclads

In the spring of 1862, Mallory approved plans for the two ironclads the *Raleigh* and the *North Carolina,* to be constructed at the shipyard at Wilmington, North Carolina. Wilmington is the largest town and principal port in North Carolina. By the end 1862, it had become the most important center for blockade running in the Confederacy. The city was a "beehive" of maritime activity with docks, wharfs, yards, warehouses, and foundries (Still 1971, 165). When ordering the construction of the ironclads, Mallory also transferred Commodore William Lynch from a western squadron so that he could supervise the building of all ironclads in North Carolina. Unfortunately, Lynch did not get along either with the local military commander General William H. C. Whiting, or with the State Governor Zebulon B. Vance (Luraghi 1996, 274).

In the fall of 1862 at the North Carolina sounds, a major Union amphibious operation had struck and caught the Confederates unprepared. They sailed nearly seventy miles up the Neuse, Tar, and Roanoke rivers and took the cities of New Bern, Washington, and Plymouth, respectively. To protect this vital area (the main blockade running zone), Mallory decided to build two more ironclads. The firm Howard and Ellis constructed the first ironclad at a shipyard in Whitehall, a small village on the Neuse River, and appropriately named the ironclad the *Neuse*. The second ironclad shipbuilders J. C. Martin and Gilbert Elliott from Elizabeth City, North Carolina, had the contract and started its construction on the Roanoke River at a place called Edward's Ferry, and named it *Albemarle* (Luraghi 1996, 275).

The same work stoppages that affected other ironclads' construction hampered the four in North Carolina as well. The usual problems were compounded by several other

factors. Admiral Lynch's battle with the local Army Commander and the state governor amplified the problems of obtaining iron for the vessels as well as getting rail cars to ship it. They also had a major problem with getting sailors to man the ironclads. There were only sixty sailors on the Confederate payroll in North Carolina, although there were plenty river sailors in the land forces, only "blue water" sailors could transfer to the Navy (MacBride 1962, 95).

The *Neuse* and *Albemarle* were having there own special problems above the normal ones. In December 1862, a Union raid damaged the *Neuse* when shells were shot through her hull. The project was then turned over to the Navy and, when the hull was repaired, she was towed to Kinston for completion (Still 1971, 156). The *Albemarle*, also under the constant threat of Union attacks, was constructed in a cornfield. There was no shipyard, or anything else for that matter, in the area. The location was selected for its concealment from Union forces, so not to be flooded by a rising river. On trying to launch her (by literally dragging it into the river), the *Albemarle's* hull was damaged. She then was towed up river to Halifax to perform repairs to her hull and to be fitted out with her guns (Luraghi 1996, 278).

In the fall of 1863, the *North Carolina* and *Raleigh* were put in service (Luraghi 1996, 274). With all shipbuilding facilities available, it is mystifying why the two ironclads built at Wilmington (especially *North Carolina*) have been described as the most poorly built of those constructed by the Confederates (Still 1971, 165). The *North Carolina* had such unreliable machinery, she was primarily used as a floating battery. She spent most of the time at anchor near the inlet of Cape Fear River protecting the

inbound and outbound blockade-runners. Her undignified end came when she sank while moored from a worm-eaten bottom.

On 6 May 1864, *Raleigh* crossed the bar of Cape Fear River to attack the blockading squadron. The attack is believed to have been a diversion for planned combined operation with the *Albemarle* in support of the Army at New Bern. The *Raleigh* chased the Union blockading squadron through the night and by morning engaged four ships at long range until they scattered and sailed out toward open ocean. However, on the *Raleigh's* return to port she ran aground and due to her massive weight, the keel was broken and the ship was lost (Luraghi 1996, 299).

The *Neuse* was completed in May 1864 in time to steam to New Bern for a combined operation with the Army. Unfortunately, the River water level had fallen several feet in the past few days, and the *Neuse* ran aground a half mile from her anchorage. Because of the depth of water and obstruction, the *Neuse* remained penned in around Kinston. This is where she stayed until Sherman's Army occupied Kinston, and her crew destroyed her to keep from being captured (Still 1971, 221).

The *Albemarle*, commissioned in April 1864, became one of the most successful Confederate ironclads of the war and has the distinction of being the only ironclad destroyed by a Union weapon. On 17 April the *Albemarle* was commissioned and immediately set sail on a combined operation with the Army to attack at Plymouth. With ship workers still onboard, she slowly steamed down river and by the evening of 18 May had all mechanical problems solved. The next morning the *Albemarle* engaged the Union ships near Plymouth sinking one and damaging another. Once the remaining Union ships had fled, the *Albemarle* began its mission, naval surface fire support for the attacking

Confederate infantry. The *Albemarle* pounded the Union soldiers for the next eighteen hours while the confederate Army reclaimed Plymouth (Still 1971, 161).

The *Albemarle* tried a daring operation in May 1864. The Army needing an ironclad to help in their attack at New Bern and after the *Neuse* ran aground, the *the Albemarle* tried to cross from the Roanoke River through three sounds and up the Neuse River to New Bern. On 5 may 1864, the *Albemarle* entered the Albemarle Sound and was met by seven Union ships, all wooden but out gunned *Albemarle* fifty-six to two. After the battle, two Union ships were disabled and the rest fled. The Confederate ironclad could not continue, however, her smokestack, seriously damaged, could not keep steam pressure up. The *Albemarle* retreated to Plymouth for repairs. While there, General Butler's Army and Naval forces turned toward Richmond; therefore, the *Albemarle* was to stay and protect Plymouth (Luraghi 1996, 298).

While in the Roanoke River, the *Albemarle* posed a significant threat to any Union force trying to enter the Sound. For this reason the Union forces took her very seriously and that is why, on 27 October 1864, the Union resorted to a form of warfare that the Confederates perfected and the Union Navy despised--torpedo (mine) warfare. That night a small steamer with a spar torpedo slipped into Plymouth's approach and rammed the *Albemarle,* and within minutes, she sank (Still 1971, 213).

Alabama Ironclads

The Alabama General Assembly, on 8 November 1861, appropriated $150,000 for the construction of an ironclad for the defense of the Mobile bay and harbor. In December, a special commission purchased the *Baltic,* a lighter used to transport cotton, and within a month, the work of converting her into an ironclad was underway. There was no difficulty in obtaining labor and material since Mobile was a small boat and shipbuilding center before the war. Therefore, except for the iron plate, all materials for the conversion were found locally.

On May 27, the conversion was completed, and the vessel turned over to the Confederate government. The *Baltic* was 186 feet in length, 38 feet in beam, with a draft of approximately 6 feet; armed with four guns; fitted with a ram; and powered with two high-pressure steam engines connected to side wheels. She was an unmanageable and slow ship that was unlivable for her crew. Nevertheless, she remained the only confederate ironclad operating in Mobile Bay until the *Tennessee* was commissioned in 1864 (Still 1971, 80).

Admiral Buchanan was the new flag officer in charge of the naval forces in Mobile. Shortly after reaching Mobile, he warned Mallory that the squadron would be no match in an engagement with Union ironclads. All that he could hope for was the attack would be delayed long enough to allow completion of the two ironclads under construction. On 1 May 1862, Henry D. Bassett, a Mobile shipbuilder, signed a contract to build two ironclads. The *Tuscaloosa* was to be completed by July 1862, and the *Huntsville*, August. He selected the small city of Selma, 150 miles from Mobile up the Alabama River (figure 10). An iron foundry and arsenal were being developed at Selma

and promised to provide the guns, boilers, and armor plate for the vessels. Commander Ebenezer Farrand was engaged in selecting defensive sites on the Alabama Rivers. Early in September he negotiated for a sidewheel vessel named *Nashville,* to be built at Montgomery and for a powerful ram to be built at Selma. By September 1863, there were at least seven ironclads under construction in Alabama. The four named, three in Selma, and one in Montgomery were completed (Still 1971, 190).

By August 1862, the three ironclads at Selma were only one-third complete. The work came to a stop waiting for iron plating and machinery. By January 1863, the machinery for the *Tuscaloosa* was installed, but the *Huntsville's* boilers and engine did not arrive before the vessel was launched and towed to Mobile. Machinery for the *Tennessee* and the *Nashville* in Montgomery was obtained from Mississippi riverboats stranded on the Yazoo River (Still 1971, 191). Iron plate to cover the *Tuscaloosa* arrived by January 1863 from the Scofield and Markham works in Atlanta. Both Atlanta and Shelby works supplied armor for the *Huntsville* and *Tennessee.* The *Nashville* was only partly clad with armor taken from the *Baltic.* On 7 February 1863, the *Tuscaloosa* and *Huntsville* were launched, and three weeks later the *Tennessee* was launched (Still 1971, 192). The *Tennessee* and *Huntsville* launched before completion to take advantage of the high water on the Alabama River. The *Tuscaloosa* steamed to Mobile under her own power, but the other two were towed.

Once in Mobile the *Huntsville* was completed, and both she and the *Tuscaloosa* performed engine trials that proved poor, neither of them had enough power to overcome the current of the river. Therefore, in the fall of 1863 they were commissioned and utilized as floating batteries. Due to the delays with the *Tennessee*, the *Nashville's*

construction was put on hold. Admiral Buchanan decided to finish each ironclad one at time (Luraghi 1996, 282). On 16 February 1864, the Tennessee was commissioned.

The armament for the ironclads came from several locations, some from Selma Works, some from Tredegar, and the rest from stationary floating batteries out of the bay. The *Huntsville* and the *Tuscaloosa* had four guns each. Each with one 6.4-inch Brooke rife and three 32-pound smoothbores. The *Tennessee* had six guns, two 7-inch Brooke pivot rifles and four 6.4-inch Brooke rifles. The *Nashville* had three 7-inch Brooke rifles (Still 1971,195-196).

On 5 August 1864, the West Gulf Blockading Squadron under the command of Admiral Farragut attacked. In the battle of Mobile Bay, Admiral Farragut's naval forces, consisting of eleven ships, four of which were ironclads, were against Admiral Buchanan's *Tennessee* and three wooden gunboats. The *Tennessee* was overwhelmed and surrendered, the *Huntsville*, *Tuscaloosa*, and *Nashville* remained near Mobile and provided protection as long as possible. On 12 April 1865, the *Huntsville* and *Tuscaloosa* were sunk to keep them from being captured and the *Nashville* was surrendered. The *Tennessee,* like the *Atlanta*, was immediately repaired and placed in the Union Navy where she was considered a very valuable addition to the West Gulf Blockading Squadron (MacBride 1962, 123).

Tennessee Ironclads

Like the shipbuilding program initiated in New Orleans, Mallory turned to a private entrepreneur to build two ironclads in Memphis to protect the upper Mississippi River. Shipbuilder John T. Shirley was authorized to build two ships, the *Arkansas* and

the *Tennessee* on 23 August 1861. The ironclads were to be completed by 24 December 1861, or the builder would incur high penalties. Obviously, this was a very ambitious time schedule (Still 1971, 62).

The ironclad construction was delayed from the beginning. Memphis lacked laborers, in particular carpenters because of the conscription of the Confederate Army. By December, the labor situation was so bad Mallory had to plead with the Army to release men in order to work on the ironclad. These pleas remained mainly ignored until March, when General Beauregard took command of the Army of the Mississippi. Workman and materials began to flow; however, it was to late to save the *Tennessee* (Still 1971, 63).

On 27 April 1862, the day after New Orleans fell, Shirley destroyed the *Tennessee* (which was still on blocks) and launched the *Arkansas* to tow her down river. The ship, now in Greenwood, Mississippi, sat for a month with its machinery and armament scattered on the decks. During this time, the *Arkansas* was under command of a "less than energetic" officer named Lieutenant Charles H. McBlair. When Mallory received word that nothing was being done to *Arkansas* while in Greenwood, he immediately fired McBlair and replaced him with an "old salt" who had twenty-eight years of service in the United States Navy, Lieutenant Isaac N. Brown. The *Arkansas's* storied performance is largely a story of the determination of Brown. Robert MacBride writes:

> Lieutenant Brown was precisely the type of man the South needed in order to create a navy. He was tough, energetic, and driving. Nothing discouraged him. There was no steam hammer at Greenwood; he built one; no gun carriages; he designed some and had them built; the barge bringing the iron from Memphis

> sank and had to be raised; he raised it; meanwhile recruiting and training a crew. He soon had 200 men working 2 shifts and 14 forges. (MacBride 1962, 134)

To keep from being trapped at Greenwood after the annual drop in the river, Brown moved the *Arkansas* to Yazoo City. In Yazoo City, Brown and the crew were working around the clock. On 20 June 1862, the *Tennessee* moved again because the Yazoo River was dropping, twenty-five miles down river to Liverpool Landing. And on 14 July, she was underway for Vicksburg. In June, General Earl Van Dorn, Commander at Vicksburg, saw his city being approached by Admiral Farragut moving up from New Orleans and by Admiral Charles H. Davis, Commander of the Western Gunboat Flotilla, descending from Memphis. He requested and received the services of the *Arkansas* (Still 1971, 66).

On 14 July, as the *Arkansas* approached the inlet to the Mississippi River, she encountered Union warships, one ironclad and gunboats, on a reconnaissance to obtain the condition of the *Arkansas*. Within two hours, the Union ironclad was disabled and aground, and the two gunboats were running toward Vicksburg for protection by over thirty Union ships at anchor. During the engagement, however, the *Arkansas* suffered some critical damage. The most injurious was in the smokestack area, and she could now only make three or four knots. As the *Arkansas* neared Vicksburg, Brown could see Davis' gunboat flotilla anchored on the Louisiana side of the Mississippi and Farragut's fleet across the river near Vicksburg (Still 1971, 69).

Brown "ran the gauntlet" near Farragut's fleet. While heading to the protection of the Confederate shore artillery, the *Arkansas* inflicted great damage on several Union ships at the same time she received serious damage herself. She moored at a wharf in

Vicksburg and immediately disembarked her dead and wounded. Admiral Farragut, humiliated by *Arkansas's* appearance, made it his personnel responsibility to sink her. For the next seven days he tried and failed. After the last attempt on 22 July, he and his fleet left Vicksburg and headed back to New Orleans. Two weeks later, the *Arkansas* was underway heading for Baton Rouge (Still 1971, 75).

On 3 August, Lieutenant Stevens, the ship's executive officer, got the *Arkansas* underway. Brown had to stay behind on sick leave due to the injuries received in the previous battles. Unfortunately for her crew and the Confederate Army waiting for her in Baton Rouge, the *Arkansas's* engines gave out on her several times on the trip and had to be repaired. While within sight of the Union gunboats on the Mississippi, her engines failed for the last time, and Stevens destroyed her to keep her from being captured (Still 1971, 78).

Conclusion

Most historians view the Confederate ironclad program a failure. They base this on two assumptions: ironclads were built to break the blockade and that only a few of the ships became operational.

Realizing ironclads bought from abroad were not going to make it to the Confederacy in numbers and the timetable needed, Mallory authorized the first five ironclads constructed as offensive ships to break the blockade. Then in 1862, Mallory formulated his new ironclad strategy. Due to the Union's successful amphibious operations in the Atlantic coast and the ever-growing cries for protection, Mallory began

his "homemade" ironclad program to have "floating fortresses" in harbors for the protection from Union attacks.

Because of the difficulties with materials and factories enumerated throughout this chapter, the Confederates were only able to complete twenty-four, including the conversions, out of over fifty-five started (Still 1971, 227). Moreover, the ones completed were called "makeshift." However, although they may have had a crude appearance, they were formidable. The presence of the *Virginia,* and later of the ironclads in the James River Squadron denied the Union forces control of the James. The *Albemarle's* combined operation against Plymouth in the spring of 1864 played a significant role in the Confederates victory and threatened the Union's control of the North Carolina Sound. Furthermore, the *Arkansas'* operations on the Mississippi sent fear into Union naval officers and more importantly, helped convince the Confederate government the need for ironclads to defend Southern ports and harbors. Luraghi writes, "In sum, it may be said that the Confederate ironclads, overcoming great obstacles, had succeeded in implementing the defense strategy that Mallory had assigned them" (Luraghi 1996, 299).

CHAPTER FOUR

CONFEDERATE MINE WARFARE

> The prospect of striking enemy warships beneath the waterline so as to deal them a mortal blow had obsessed the minds of strategists and scientists from the earliest days of the war at sea. After the introduction of the shell gun and the answer to it--the ironclad--and the invention of the underwater screw propeller, this need became urgent. (Luraghi 1996, 234)

In the past century, underwater warfare, submarines and mines, has emerged as one of the world's leading weapons of military power. Although the Confederates did not invent those weapons, they did use emerging technological breakthroughs to improve them. The contributions by essential Southern leaders enabled the South to make this form of warfare an integral part of its naval strategy. The new emphasis in submarine warfare, in particular harbor and river defense, changed the face of naval warfare.

As early as 1588, after the invention of explosive powder, mines were a means of causing damage to enemy ships. It was not until about 1771 that the American inventor David Bushnell devised a method of delivery that would strike a ship below the waterline. Bushnell used a small submersible boat called the turtle to deploy his mine (Stern 1962, 172). From the beginning, submarines and mines were developed in concert because the inventors could not solve two problems: (1) explosion below the waterline, which would cause more damage to the vessel and (2) timing of the detonation (Luraghi 1996, 235). Bushnell was unsuccessful in his 1776 attempt to strike the flagship, *HMS Eagle*, in New York Harbor. However, his belief that "covert submerged attacks might be a weak nation's challenge to a strong maritime power" (Compton-Hall 1983, 35) was a concept that the Confederates closely embraced. Two other inventors that followed

Bushnell's path of underwater warfare were Robert Fulton and Samuel Colt.

Fulton, the inventor of the steamboat, improved Bushnell's work and made a much more advanced submarine to deliver his "torpedoes." Fulton, however, was at a disadvantage because of his timing. He could not generate enough interest in either France or England to advance his ideas. Fulton first tried to convince the French government the importance of his weapon system but failed. He turned to the English but had the same outcome. Perhaps, it was not the lack of interest or understanding that kept these two nations from using Fulton's underwater machine but more from the fear of it (Luraghi 1996, 251). Fulton loathed a nation's navy that could interdict or cut off another nation's sea lines of communication. He believed that his weapon would render any country's navy obsolete. Therefore, all nations would have open and free use of the sea (Luraghi 1996, 235). Maybe France and England agreed with him. The one idea of Fulton's that did survive was the term "torpedo." He named his underwater explosive device after the fish torpedo electricus that was capable of paralyzing its prey with an electric shock (Schafer 1996, 10).

Samuel Colt, inventor of the revolver, took the advancements of Bushnell and Fulton and improved them with new technologies brought on by the industrial revolution. As observed earlier, one of the difficulties of mine warfare was causing the explosion to occur precisely when it will do the most damage to the intended target, while it is next to the ship's hull. Colt was working to solve this problem by using the new technology of electricity. Colt, using the battery invented by Alexander Volta in 1777, made the first electrically detonated torpedo (Luraghi 1996, 235). He overcame a major obstacle in electrical mines by working with Samuel Morse, who was experimenting with

underwater telegraph and the development of insulated (waterproof) electrical telegraph cables. Colt successfully demonstrated his new electric torpedo to the U.S. military leaders but ran up against a conservative establishment that was unwilling to change. Although the torpedo found use in several conflicts during the 1840s and 1850s by the Germans, Austrians, and the Russians, none used Colt's design, so they all were rudimentary floating mines. After the rejection of his torpedo, Colt turned his attention to other adventures but not before influencing the prominent leader in Southern torpedo technology Matthew Maury. Maury and others, discussed later in this chapter, took the advances in underwater warfare and substantially improved them.

Confederate Improvements in Technologies

The experiments by other inventors had revealed flaws in both delivery and detonation systems that made torpedoes of little practical value. It was in these two areas of delivery and fuses that the Confederates supplied breakthrough torpedo technology. Two early Confederate failures in July 1861 showed the problems of using torpedoes.

> On the night of 7/8 July 1861 he [Maury] attacked two Union flagships moored in Hampton Roads. His arrangement was the now familiar pair of floating mines connected by rope. These were planted above the enemy ships and allowed to drift down upon the mooring lines and into place alongside the vessels, just as those of Bushnell, Fulton, Mix, and others had been designed to do. The fuses proved unsatisfactory and the attempt failed. (Roland 1978, 152)

The Confederates were legitimately displeased with this inefficient method of detonation. They became determined to create a torpedo system to use against specific ships.

Electrically detonated mines became a mainstay in the Confederate arsenal. This form of detonation, however, had its own drawbacks. One was obtaining insulated wire to run from the batteries ashore to the torpedo. The science of electricity was still in a

very young state. Maury enlisted the services of Dr. William Norris, Chief Signal Officer of the Confederacy and the South's leading expert in electricity. Norris provided a great deal of technical data and more importantly, an adequate supply of used Federal underwater cable. Maury referred to the cable, Norris confiscated from the beaches of Willoughby Spit following a storm, as a "God-send" (Schafer 1996, 20). Another problem to overcome was the lack of suitable batteries. Because of the shortage of batteries in the South, Hunter Davidson, another leader in submarine weaponry, had his navy electrician develop a battery made with materials on hand. R. O. Crowley developed a homemade battery used for electrical detonation of his torpedoes. Crowley said in describing his battery as:

> with the zinc plates formerly used in the Wollaston battery in our early experiments, I had a number of zinc cells cast in the shape of an ordinary glass tumbler, having a projecting arm for a handle as well as to connect it with the next adjoining cell in the series. The inside of these zinc tumblers was amalgamated with mercury, and a solution of sulphuric acid, composed of one part of acid and thirteen parts of water, was poured into each tumbler or cell. In this solution was placed a cylindrical porous cup, open at the top, and filled with nitric acid. In the nitric acid was immersed a piece of cast-iron having four projecting leaves and a projecting handle connected with a corresponding handle of the adjoining zinc cell by an ordinary brass clamp (Crowley 1898).

Consequently, Crowley's battery was dramatically smaller and produced an electrical current beyond the distance of two miles. Another detonation problem requiring resolution was with the fusing of torpedoes.

The key to a successful explosion of a torpedo was the invention of a reliable chemical fuse. Captain Lee (discussed later in this chapter) developed an advanced chemical fuse consisting of

> small lead tubes capped with hemispherical heads of very thin metal. Inside, he placed hermetically sealed glass phials containing sulphuric acid. Between this

> and the metal casing was a layer of a composition of his own invention: a combination of chlorate of potassa, powdered sugar, and fine rifle powder. Several of these fuses screwed into a container of powder (50-75 pounds) made a most dangerous weapon, for if the rounded cap were dented enough to crush the phial, the acid, acting on the composition, would ignite the powder and cause a sizable explosion. (Perry 1965, 64)

This new fuse made the torpedo a new dangerous means of applying the destructive force to enemy ships. The new technologies improved upon by the South made the torpedo a reliable and lethal weapon. It still took innovative, forward-thinking Southern leaders to make this form of warfare a cornerstone in Confederate naval strategy.

At the time of the American Civil War, underwater weapons were just an interesting idea held by a few inventors. This idea stayed, however, on the fringe of accepted practices in naval warfare. In fact, its proponents were above all, trying to "sell an idea" more than a weapon. For the South, Matthew Fontaine Maury took it upon himself to sell torpedoes to the new government. Therefore, due to the lack of bureaucracy in this new nation and the since of urgency felt in the South, this new "military industry" was able to experiment, improve, and implement these new weapon systems "on the fly." This environment proved to be ideal for development of equipment and tactical employment.

Confederate Leaders in Torpedo Warfare

The first man assigned the responsibility for torpedo warfare for the Confederates was Matthew Maury. He was Born in Virginia in 1805, joined the United States Navy at the age of twenty, and revealed a mind more suited for science than that of a naval officer. Although he spent many years at sea, he was finally appointed as superintendent of the Depot of Charts and Instruments, which became the United States Naval

Observatory and Hydrographic Office. At this position, he wrote his famous *Winds and Current Charts of the North Atlantic* in 1847 and *The Physical Geography of the Sea* in 1855. He played a vital role in the first transatlantic cable and mapped two ocean lanes across the Atlantic to prevent collisions. It was at this time he met Samuel Colt, who was giving his demonstration of underwater detonation in Washington. After the secession of Virginia, Maury immediately left the Union and moved his family to Fredericksburg, Virginia. Within one day of arriving at Virginia, he was appointed to a three-man advisory council for the protection of Virginia's waterways. Louis Schafer wrote:

> Maury's unique ability to assimilate a vast amount of facts and figures at a rapid pace offered him a rather bleak mental image of the state's inadequate defense … To make matters worse, the state possessed only about 3,200 barrels of gunpowder at the time. It was, therefore, crystal clear to the middle-aged scientist from Virginia, if not the entire Confederacy, would have to incorporate drastic measures in order to overcome the immense firepower of the Union forces. (Schafer 1996, 12)

Maury therefore insisted on the adoption of the innovative underwater weapon the torpedo to defend Virginia's vast waterways. He believed this weapon would effectively defend the harbors, bays, and rivers throughout the region. Maury soon found out it was extremely difficult to convince the Southern authorities that underwater explosives were the answer to the defense problem of Confederate waterways. One of the most important contributions by Maury to the Confederacy was his stubbornness in believing of the necessity of torpedo warfare and finally winning over the Southern leaders, both military and political, to this idea.

Before Maury won the confidence of the Confederate politicians, he decided to experiment with torpedoes without their approval. In 1861, in a house just a block away from the Confederate Executive Mansion, Maury spent many hours setting off small

explosions in a metal washtub. Maury experimented with fuses developed with the assistance of Richmond industries and scientists in Virginia. Maury's experiments were a concentrated effort to perfect torpedoes to convince, among others, his own Stephen Mallory of the necessity of torpedoes (Coski 1996, 113). In August of 1861, Maury had his opportunity to show the effectiveness of an underwater weapon.

Maury conducted a successful demonstration of a torpedo in the James River off Rocketts before a special audience. In attendance were Virginia's governor John Letcher; Confederate Navy Secretary Stephen Mallory; and selected Confederate congressmen in the Congressional Committee on Naval Affairs. Maury used a small boat borrowed from the *Patrick Henry* to deploy an oak cast, built by Talbott and Son Company, and packed with powder. The ensuing explosion caused applause from all in attendance. However, more importantly, the Confederate Secretary of the Navy immediately appointed him Chief of the Sea-Coast, Harbor and River Defenses of the South with the rank of captain. It also convinced the Confederate Congress to appropriate $50,000 for Maury's torpedo experiments (Perry 1965, 6). Maury was disappointed, however, that the demonstration had to be a very basic experiment. He had hoped to use his new electrically detonated torpedoes, but due to the critical shortage of insulated electrical wire, he had to use a mechanical torpedo.

Electric torpedoes, however, did become a mainstay of the defenses of the James River and of other Southern rivers and harbors. Maury, with the assistance of Lieutenant Hunter Davidson, devised a system capable of reliable detonation to a depth of fifteen feet. In a message to the Confederate Secretary of War George W. Randolph, Maury wrote, "I beg to call your attention to our river defenses, and to say that the most effectual

way of keeping off the enemy with his shot-proof vessels is to mine the channelways, and blow up by means of electricity when he attempts the passage" (Schafer 1996, 20-21). Randolph agreed with Maury and granted him permission to use electric torpedoes. Maury described them in detail:

> They (torpedoes) were arranged in rows, those of each row being 30 feet apart. Each tank is contained in a water-tight wooden cask, capable of floating it, but anchored and held below the surface from 3 to 8 feet, according to the state of the tide. The anchors to each are an 18-inch shell and a piece of kentledge.... The wire for the return current from the battery is passed from shell to shell along the connecting rope, which lies at the bottom. The wire that passes from cask to cask is stopped slack at the buoy rope from the shell up to the cask..... The return wire is stopped in like manner down along the span to the next shell. (ORN Ser. I, 7:543-544)

Torpedoes successfully destroyed several Union vessels and played a vital role in the protection of Southern ports. In a postwar speech in France, Maury said, "All the electrical torpedoes in that river were prepared and laid either by myself or by Lieutenant Davidson.... These were the first electrical torpedoes that were successfully used against an enemy at war" (Maury 1866). There is no doubt Maury is responsible for establishing the foundation for underwater warfare during the Civil War. As Maury laid the foundation for underwater warfare, Hunter Davidson made it practicable and successful. In June 1862, Lieutenant Hunter Davidson, Confederate States Navy (CSN), replaced Maury as head of the Torpedo Division. Maury traveled to England, where he continued his work in mine development. He did not return to America until after the end of the war (Coski 1996, 124).

Hunter Davidson served in the United States Navy for twenty years before joining the Confederacy in 1861. In the first year of the war, Davidson commanded one of *CSS Virginia*'s guns during her operations in Hampton Roads. From the *Virginia*, he received

a special assignment to ordnance technology, as Maury's assistant until relieving him of his duties in June 1862. When the Submarine Battery Service originated in late 1862, Davidson became chief of the organization. They operated primarily on the James and Cape Fear rivers of Virginia. Though the force was small, it was flexible enough to spread out to other points throughout the region. Other than Davidson himself, there was an electrician and his assistant, two men at each battery station on shore, three telegraph operators, two scouts, and the crew of a tugboat, in all, approximately fifty men (Schafer 1996, 29).

The Confederate Congress passed legislation in October 1862 to organize the different mine warfare operations (Figure 11). Before this legislation there were several individuals working in the field of submarine weaponry, all working under a separate instructions and unorganized. The new legislation authorized three organizations to be responsible for development, training, and application of torpedoes. They were the Secret Service Corps, Confederate States Submarine Battery Service, and the Torpedo Bureau. The Secret Service worked on land and will not be discussed. The Torpedo Bureau was an Army organization, which concentrated on mechanical mine technology, with General Gabriel Rains in charge. The Submarine Battery Service was a naval operation, commanded by Hunter Davidson that concentrated on the use of electrical mines. In addition to organizing the Southern effort, this legislation essentially legalized mine warfare. It extended legal protection and prisoner-of-war rights for those involved in mine warfare activity (Perry 1965, 31). The result was an attempt to convert an ad hoc organization into a centralized control and government supported program.

Davidson carried on the labor of electric mines that Maury began in 1861. Davidson immediately developed a completely new system and later wrote that his work resulted in: "the organization of a department, the application of an electric battery of convenient size and sufficient strength to the explosion of submarine mines; the construction of a large number of wrought iron mines (at the Tredegar Works), holding 1,800 pounds of gunpowder, which were placed at a depth of seven fathoms; the importation of insulated cable to connect the mines and the electric batteries; the manufacture of the platinum or quantity fuse, which alone was used in the electrical defenses around Richmond, and in those at Charleston" (Davidson 1896, 285-286). By January 1863, Davidson's organization had nine electrical torpedo stations on the James River linked to each other and Navy Secretary Mallory's office by telegraph (Davidson 1896, 286). Davidson did little, if any, work with contact mines. In postwar writings, he did not consider contact mines effective and thought them to be an unreliable weapon, believing electrical mines to be superior in every respect (Davidson 1876, 3).

Davidson and his crew contributed greatly to the defense of the James River. On 1 January 1863 with his system completed, President Davis, Secretary Mallory, and General Robert E. Lee inspected it. It was so overwhelming, Mallory considered the James closed to the Union fleet. It defended Richmond equal to that of a whole naval squadron or an army. The Confederate leaders even considered withdrawing troops from the district (Luraghi 1996, 245). Davidson did not confine his activity only to defensive mine warfare operations. Now that Davidson felt the defenses on the James were set, he turned his attention to a more exciting adventure. In March 1864, with command of the *CSS Squib*, he attempted to sink the *USS Minnesota* with an offensive spar torpedo, an

explosive charge attached by a spar to a manned vessel. He successfully attacked the Union ship; however, it only caused moderate damage. With all this attention on the James River, the first real successes in torpedo warfare came under the leadership of an Army General Gabriel Rains that was in charge of defending the western rivers.

General Gabriel J. Rains, Confederate States Army (CSA), began his military service in the U.S. Army. In 1840, during the Seminole Wars in Florida, Rains made use of a land mine, when in command of a company of the Seventh U.S. Infantry at Fort King (Rains 1877, 257). Placed in charge of the Confederate Torpedo Bureau, Rains was responsible for both land and naval mine warfare operations. He developed a very sensitive contact fuse (Figure 12), that made the Rains keg torpedoes the most common used for coastal and harbor defense. "Lager-beer barrels were confiscated everywhere in the Confederacy for making these instruments, and when caulked and pitched, loaded with from 35 to 120 pounds of powder, capped with friction fuses and moored in a channel ... they proved excellent for defense, causing the loss of more vessels than any other kind used by the Confederates" (Scharf 1887, 757).

The key to the success of the Rains' torpedo was the highly sensitive fuse which could be detonated with just seven pounds of pressure. The construction of the "Rains fuse," carefully guarded throughout the war, became known after the war. Each torpedo contained fuses made up of fifty parts potassium chlorate, thirty parts sulphuret of antimony, and twenty parts powdered glass. The way the keg torpedoes were constructed; gravity forced the fused side upward, so these sensitive primers activated whenever a thin, copper protective shield was slightly dented. This would cause Rains' chemical mixture to detonate, thus setting off the explosive.

Rains was initially made commander of the submarine defenses of the James and Appomattox rivers to help General Lee's defenses on the James from Union Navy attack. Maury was already in charge of electrical torpedoes in that area, but the Confederates needed to make the explosive at a much faster pace. Understanding the overall importance of torpedoes in defense of Southern ports, Rains said: "Ironclads were invulnerable to cannon of all calibre used and were really masters of rivers and harbors, it required submarine inventions to checkmate and conquer them" (Rains 1877, 260).

Concerned with the power of the Confederate torpedoes, the Union Navy built a device called the "Alligator" or "Devil." This machine was a raft pushed by a ship. In front, the raft had a submerged comb designed to grab the cables of anchored torpedoes then cut them so the torpedo would explode away from the ship. Rains invented a counter to the devil consisting of a wooden torpedo held on the bottom by a cable with a special slipknot. The hemp cable end would float to the surface and entangle in the teeth of the devil. The tension placed on the cable would loosen the knot. The wooden torpedo would rise to the surface and strike the ship's hull. This device was a great success and rendered the Union's mine-sweeping equipment practically useless (Luraghi 1996, 248).

By 1864, Rains established torpedo-manufacturing facilities in Richmond, Mobile, Wilmington, Savannah, and Charleston to increase torpedo production and delivery times. Before torpedo warfare could be successful, the men of the Submarine Battery Service had to be able to rely on the detonation of their devices. The detonation was almost entirely up to the quality and type of fuses used. Some of the early fuses

were as much a danger to the men who handled them as they were to the anticipated ships that they were to destroy.

Confederate Torpedoes Fuses

The Confederates knew for torpedo warfare to be successful they must be able to rely on the detonation of their devices and detonation was almost entirely up to the quality and type of fuses used. Rain's simple and safe fuse, discussed above, was one of the innovative developments in torpedo warfare. There are two other fuses that will be discussed to illustrate these devices, one used in an electrical torpedo the other in spar torpedoes.

R. O. Crowley, the Confederate electrician working with Davidson, relayed his experiences in developing a fuse for the new electric torpedoes. In *Century Magazine* in June of 1898 he wrote:

> In the cabin of this little steamer, we studied, planned, and experimented for months with various fuses, galvanic batteries, etc., and finally we decided on a system. Our first object was to prepare a sensitive fuse of fulminate of mercury, to be exploded by the incandescence of the fine platinum wire by means of a quantity of electricity. We succeeded in this, and our fuses were made by taking a piece of quill, half an inch long, and filling it with fulminate of mercury. Each end of the quill was sealed with beeswax, after fixing a fine platinum wire through the center of the quill and connecting the protruding ends of the platinum wire with insulated copper wire. Enveloping the fuse was a red flannel cartridge bag stuffed with rifle-powder. The fuse, thus prepared, was ready to be placed in a torpedo-tank containing cannon-powder. (Crowley 1898)

As shown in figure 13, the outer part was termed the stuffing box. The body (A) was made of hollow brass and threaded almost entirely. Near the top it was hex shaped, with threads making up the rest of its length. A brass ferrule (B) was inserted into the top. This piece had two holes which allowed the wires to be passed through. It was

secured to the body by a brass cap (C) which had a hole in its center. There was a "hollow area" between the body and the ferrule (D). This was packed with cotton "junk" and tallow. The fuse itself was made from a "slip" of pine (E) that had two grooves cut into its sides to hold the wires and tapered at the end. The wires were stripped bare of insulation. At the end of the stick is a small piece of goose quill (F) with a hair thin platinum wire passing through it and filled with fulminate of mercury. The quill tied to the end of the stick with thread and the ends of the platinum wire were then attached to the copper wires.

Tests of this particular fuse produced an explosion within one or two seconds. The fuse was first inserted into an opening in the side of a torpedo, then placed on a bed of powder. The wires then carefully secured to the fuse, the torpedo filled the rest of the way with powder, and it was then ready for the water. Most of the electric fuses utilized on the James River were of this style. Their design was simple making them easy to build and repair.

The next phase of torpedo warfare was the development of a percussion fuse for the new offensive weapon, the spar torpedoes. The need for a safe and reliable percussion fuse was obvious. The spar torpedo, attached to the bow of a torpedo ram, contained a heavy load of gunpowder and a sensitive chemical fuse ready to explode on contact. The young engineering officer Francis D. Lee, who served on the staff of General Pierre G. T. Beauregard in Charleston, South Carolina, surmised: "the best torpedoes ... were those that could be detonated by chemically-reacting fuses" (Schafer 1996, 82).

The fuse Lee developed was made up of small lead tubes topped off with caps constructed of very thin metal. Within this, similarly shaped glass test tubes, hermetically sealed, were inserted after filling with a sulfuric acid concoction. Between the glass and metal covering was a layered composition of the formula: "a carefully measured dose of chlorate of potassa, powdered sugar, and very fine rifle powder pellets" (Schafer 1996, 82). When the thin outer jacket of lead met a hard surface, it would dent. This would shatter the interior glass tube and force the sulfuric acid to mingle with the chlorate of potassa, powdered sugar, and gunpowder. The flame produced by the chemical reaction would lead to an instantaneous explosion of the gunpowder within the torpedo case. After perfecting the detonating device, Captain Lee designed a copper cylinder that held 50 to 150 pounds of gunpowder (Schafer 1996, 83).

Shown in figure 14, the fuse was made of a threaded brass hexagonal body. In this was a small glass vial of sulfuric acid (A). A soft lead cap was placed over the vial. The vial was secured in place with a mixture of chlorate of potash and white sugar. This rested on a primer filled with quick match leading to the bottom of the fuse. When the vial was broken and the acid mixed with the potash and sugar mixture, the resulting reaction produced an explosive gas and an excessive amount of heat. This heat then ignited the finely ground sugar which, in turn, ignited the primer. In all, the resulting explosion was almost instantaneous.

Confederate Torpedoes

Confederate torpedoes are classified in two basic categories, offensive and defensive torpedoes. The fixed torpedoes were considered defensive in nature, and spar

torpedoes were considered an offensive weapon. Although there was a great deal of local innovation, the Confederates used three basic types of defensive naval mines. These were frame, floating or moored, and electrical. Each designed for a specific type of environment.

Frame torpedoes, figure 15, functioned as both a mine and an obstruction. They were usually placed in narrow, shallow channels at the entrances to creeks and rivers. The submerged frames were constructed of timber on which were fastened one or more mines. The frames were constructed so the mines would float immediately below the water's surface. The mines used either a percussion or chemical contact fuse. Frame torpedoes were considered by Union naval officers to be very difficult to force a passage through. They were used extensively at Charleston, Wilmington, and Mobile (Barnes 1869, 66).

The frame torpedo was responsible for several strikes during the war. On 28 February 1863, the ironclad *Montauk* came across a frame torpedo.

> Their mission accomplished [destroying the blockade-runner, Nashville], the Union squadron broke off and withdrew, carefully keeping in the same tracks they had used when entering the river. At 9:35 A.M., a few yards above a creek known as Harvey's Cut, the *Montauk,* still under fire from the fort, shuddered, raised in the water, and slewed around violently knocking her crewmen off their feet. There followed what was described as "a violent, sudden and seemingly double explosion...." Water poured through a rupture in the *Montauk's* iron skin ....
>
> The *Montauk* was steered onto a nearby mudbank, and at low tide an inspection was made of the hull. Some of the bottom plates had been forced upward three and a half inches in a three-by-five-foot area; a ten-foot crack zigzagged down her side--all evidence of tremendous strain. A spare piece of boiler iron was patched over the rip, and, with her pumps running, the monitor managed to stay afloat during the tow to Port Royal, South Carolina. (Perry 1965, 40)

The buoyant or moored mine took many forms during the war. The two most common moored mines in the Confederate inventory were the keg and Singer torpedoes. The keg or Rains torpedo, figure 16, was constructed from small barrels, preferably those used to stored lager beer. They were waterproofed by using pitch inside and out, with cones constructed of pine attached to each end of the barrel in order to stabilize the barrel while moored in currents of the rivers and streams. They ordinarily had between 50 to 120 pounds of black powder and had five or more contact fuses on the top of the barrel. A hemp line attached to a weight on one end and fixed to the barrel on the other prepared the mine for deployment. Although keg mines were inexpensive and easy to construct, they were dangerous because they often shifted their moorings in strong currents, therefore, potentially inflicting friendly casualties (Barnes 1869, 66). Because the keg torpedoes were simple and inexpensive to make, they were the most abundant Confederate mine and caused more damage to Union ships than any other mine in the Confederate inventory. On 9 May 1864, the Union ship *Harriet A. Weed* was one ship that met a keg torpedo with devastating results.

> The next ship to feel their effect was the 290-ton transport *Harriett A. Weed* which, on May 9, struck a torpedo near the mouth of Cedar Creek close to Jacksonville, killing five men. The *Weed* had two guns and was towing a schooner when she was "blown into fragments." Aboard were thirteen officers and twenty enlisted men of the Third U.S. Colored Regiment, all of whom were "more or less injured." One of the officers was thrown twenty feet in the air. When he was pulled from the water, the *Weed's* skipper, suffering from shock, was interviewed by Brigadier General George Henry Gordon, U.S.A. His features covered with coal dust, the unfortunate man wrung his hands and moaned: "Who will come next? How are we to navigate these waters?" Gordon cynically reported that they had no choice but "to take our chances, with the pleasant feeling that at any moment we might find ourselves blown high in the air." (Perry 1965, 116)

The Fretwell-Singer metal torpedo, Figure 17, was another floating type of unique design, and was second to only the keg torpedo to frequency and total numbers used. The mine consisted of a tin case three-quarters filled with 50 to 100 pounds of powder. The remainder was air space to provide buoyancy. An iron rod ran through the torpedo with a spring-triggered plunger. A heavy metal cap on top of the explosive case and firing mechanism were also part of the device. The mine activated when a vessel would strike it, knocking off the metal cap. This would activate a plunger that forced a rod into mercury fulminate, detonating the charge. Singer torpedoes were used in both the Mississippi River basin, at Mobile Bay, and along the East Coast (Schafer 1996, 60). 13 July 1863, the *USS Baron De Kalb* fell victim to this type of mine.

> While supporting the advance, the *Baron de Kalb* was rocked by an immense explosion beneath her bow. As water gushed through a huge gash in her belly, the mighty vessel began to lag. A few moments later, a second explosion occurred just beneath her stern section, inflicting further devastation to the fragile victim's underside. Within a 15-minute period, the mighty ironclad ram would be lying helplessly on the river bottom. (Schafer 1996, 62)

Electrical mines, figure 18, the largest naval mines used by the South, were bottom mines, as a rule placed in narrow channels where navigation was restricted. In the beginning, old boilers were used, but eventually cases were made specifically for that purpose. Explosive charges were large, ordinarily about 2,000 pounds of powder. Telegraph wire was used to make the electrical connection. The fuse, as discussed earlier, was a platinum wire passed through a goose quill filled with fulminate of mercury. Voltaic batteries provided the electrical charge until Crowley devised a more reliable and manageable one. The mines were placed so one shore station could control several mines. The shore station operators used a series of range stakes so they could

determine the positions of the Union ships in relation to the mines. The James River, Charleston, and Fort Fisher used these mines with a devastating effect because of their size and explosive charge (Barnes 1869, 78). The destruction of *Commodore Jones* illustrated the effectiveness of the electrical torpedo:

> Suddenly she appeared to be lifted bodily, her wheels revolving in mid-air; persons declared they could see the green.... of the banks beneath her keel. Then, through her shot to a great height, a fountain of foaming water, followed by a dense column thick with mud. She absolutely crumbled to pieces dissolved as it were in mid-air, enveloped by the falling spray, mud, water, and smoke. When the turbulence.... subsided, not a vestige of the high hull remained in sight, except small fragments of her frame which came shooting to the surface. (Barnes 1869, 97)

Through the efforts of the great Southern inventors, torpedoes offensive and defensive, played a vital role in the defense of Southern harbors and ports. In fact, offensive and defensive mines caused more damage to Union ships that all other forms of warfare combined (table 2) (Perry 1965, 4) see table two. The stories of coastal battles and other torpedo successes spread across the country and to other nations abroad. European countries began a serious new study of these weapons, and most set up torpedo bureaus modeled after the Confederates (Perry 1965, 164). After the war, several Southern officers went to work for foreign governments. Two such officers were Hunter Davidson and James Tombs. Hunter Davidson assumed the head of the Argentine Torpedo and Hydrographic Bureau and served in that post for several years. James Tombs served as a Commanding Officer of the *Little David*, a semisubmersible torpedo ram during the war. Shortly after the war, he took a position from the Brazilian emperor as technical expert on torpedoes in the Paraguayan War of 1865-1870.

The Confederates revealed to the world that the use of mines by a nation with a weak navy was highly beneficial. It had three important impacts. Mines are inexpensive to make and deploy; they will, in most all cases cause the enemy delays in their operations or changes in their plans; and they have a significant psychological impact.

The Union sailors called torpedoes the "infernal machines," and most people during the Civil War viewed the use of submarine weaponry as "fiendish acts." But even as Admiral Farragut believed torpedoes were "unethical for use in warfare," he defied his own morals by setting explosives around his anchored squadron and justified it by saying: " I have always deemed it [torpedoes] unworthy a chivalrous nation, but it does not do to give your enemy such a decided superiority over you" (Schafer 1996, 148). Rear Admiral Dahlgren saw the vitality in mine warfare. Although publicly he condemned the use of mines as "not recognized by civilized nations", he privately admitted to United States Navy Secretary Welles: "The secrecy, rapidity of movement, control of direction, and precise explosion, indicate, I think, the introduction of the torpedo element as a means of certain warfare. It can be ignored no longer. If 60 pounds of powder, why not 600 pounds?" (ORN Ser. I, 15:16)

CHAPTER FIVE

SUBMARINE WARFARE

There were three general classes of vessels developed during the Civil War to deliver torpedoes: traditional surface craft modified to carry a spar, steam-powered semi-submersible boats or *Davids,* and hand-powered submersibles, such as *H. L. Hunley.* Two of these Southern programs, the semisubmersible steam ram and the submersible submarine were led and financed by Southern businessmen. Civilians financed these radical concepts because the Confederate leaders did not want to use precious resources to develop them.

David and Goliath

The original torpedo boat came from a civilian plant in Charleston, the Southern Torpedo Company, managed by Theodore Stoney, from Charleston, by a doctor, from the Columbia hospital, St. Julien Ravenal. Captain Francis D. Lee supervised the work, based on a plan drafted by the Southern sympathizer, from Baltimore, Ross Winan (Schafer 1996, 94-95).

Work on the small torpedo boat went slowly. Samuel Masterby was the master carpenter, D. C. Ebaugh was the chief mechanic, and John Chaulk was in charge of installing the machinery. Slaves from nearby plantations performed the actual work on the boat. In spite of the Confederacy's problems obtaining adequate materials, the builders used any and everything they could get. Dr. Ravenal procured an old steam locomotive engine from the Northeastern Railroad Company as the primary engine for

the *David*, and iron plating was obtained in this same piecemeal method (Schafer 1996, 95).

Obtaining engines was the most difficult problem in building assault boats. Mallory sought to acquire them and their boilers in England. He wrote to Bulloch, his purchasing agent in England, asking him to obtain twelve marine engines and boilers as soon as possible. Furthermore, Mallory also tasked him to buy six torpedo boats and sent the blueprints of constructor William A. Graves. Bulloch had so many projects he was trying to complete, buying ironclads and steam cruisers, that the work on the assault boats did not make it high on his to do list. On 26 January 1865, when the war was nearing the end, Bulloch wrote that six torpedo boats were ready, and he would try to ship them. The boats or boilers never made it to the South (ORN Ser 2, 2:790).

The finished product was a boat fifty feet long and six feet wide, shaped like a cigar, lightly protected by metal plating, and powered by a small but potent steam engine. It had ballast tanks, like those of submarines, to admit water into the tanks that causes it to lie low in the water until the deck is awash. An explosive attached to a spar extends from the bow and can be raised and lowered from inside the boat (Perry 1965, 81). Once delivered to Charleston Harbor, the boat was christened the *David* because of the contrast with the "Goliath" aspect of the Union Navy (Compton-Hall 1983, 35). It was the first assault boat in naval history, an early ancestor of torpedo boats used in both world wars.

To the pleasure of the designers and financiers, the *David* floated upright and sat deep in the water, with her smokestack and only a small section of the freeboard above the surface. The engineers also found that the ballast tanks worked well to bring it down even deeper, so that the curved deck was awash (Schafer 1996, 97). The spar torpedo,

attached to the end of a hollow fourteen-foot iron shaft fastened to the bow, with the ability to raise and lower, allowed the crew to position the spar at an angle to strike the target below the waterline. The torpedo was an improved variety, designed by Captain Lee and weighing approximately one hundred pounds. It came fully equipped with four ultrasensitive fuses (Luraghi 1996, 260).

The *David* had a four-man crew. Her commissioning commanding officer was Lieutenant William T. Glassel, who volunteered for the assignment. The first Executive Officer Stoney was one of her builders, but was relieved so he could go to work on production of other torpedo boats. The chief engineer was James H. Tomb. The helmsman, coming from the crew of the ironclad *Palmetto State,* was J. Walker Cannon. The stoker was sailor James Sullivan. The orders were to attack the major enemy vessels as soon as possible. When Captain William T. Glassel heard the *David* was complete, he volunteered to command her. On 18 September 1863, Glassel was placed in charge and stated:

> On examination I determined to make a trial [run]. She was yet in an unfinished state. Assistant-engineer J. H. Toombs volunteered his services, and all the necessary machinery was soon fitted and got in working order, while Major Frank Lee gave me his zealous aid in fitting on a torpedo. James Stuart (alias Sullivan) volunteered to go as fireman, and afterwards the services of J. W Cannon as pilot were secured. The boat was ballasted as to float deeply in the water, and all above painted the most invisible color [bluish]. The torpedo was made of copper.... I had also an armament on deck of four double-barrel shot guns, and as many navy revolvers; also, four cork life-preservers had been thrown on board, and made us feel safe (Glassel 1877, 230).

After a long period of training, she set out for an enemy ship. The *David* left Charleston Harbor a little after dark on the night of 5 October 1863, using the ebb tide to get through the channel. The weather conditions were at their best; the water was calm

and covered with a light fog. Glassel hoped to reach their intended target, the formidable USS *New Ironsides, a* 3,468-ton, monitor-class ironclad with eighteen big guns, at approximately the same time that the tide turned. The torpedo steamer made good time through the calm waters. Moving silently, just inside the bar, the crew had many opportunities to survey the blockading Union fleet at anchor. Glassel moved in close enough to make out the enemy campfires on shore at Morris Island and could even hear the Union soldiers' voices. Approximately 8:30 P.M., the USS *New Ironsides* was in sight (Schafer 1996, 97). The *David* then waited until complete darkness and for the tide to turn. At 2100, Glassel heard the signal for lights out and steered the *David* directly for the ironclad (Glassel 1887, 231). W. T. Glassel's account of that night was published in the *Southern Historical Society Papers* in 1877:

> Accordingly, having on a full head of steam, I took charge of the helm, it being so arranged that I could sit on deck and work the wheel with my feet. Then directing the engineer and fireman to keep below and give me all the speed possible, I gave a double-barrel gun to the pilot, with instructions not to fire until I should so, and steered directly for the monitor. I intended to strike her just under the gang-way, but the tide still running out, carried us to a point nearer the quarter. Thus we rapidly approached the enemy. When within about 300 yards of her sentinel hailed us: Boat ahoy! Boat ahoy! repeating the hail several times very rapidly. We were coming towards them with all speed, and I made no answer, but cocked both barrels of my gun. The officer of the deck next made his appearance, and loudly demanded "What boat is that?" Being now within forty yards of the ship, and plenty of headway to carry us on, I thought it about time the fight should commence, and I fired my gun. The officer of the deck [Ensign Charles W Howard] fell back mortally wounded (poor fellow), and I ordered the engine stopped. The next moment the torpedo struck the vessel and exploded .... My little boat plunged violently, and a large body of water which had been thrown up descended upon her deck, and down the smokestack and hatchway. (Glassel 1877, 231-232)

Aboard the USS *New Ironsides,* the crew heard Glassel's shot and felt the ship shudder beneath them. Her heavy rigging crashed to the deck, as the cannons, weighing

tens of tons, flew from their moorings and as a huge column of water more than one hundred feet high washed over both ships. Finally, the heavily damaged ship rolled severely to one side. Glassel ordered to reverse the *David's* engine, in hopes of backing away from the ship. However, engineer Toombs relayed that the water that had washed over them had put out the fire of the engine (Schafer 1996, 98). Toombs also said, something had "become jammed in the machinery so that it would not move" (Glassel 1877, 232).

Because of the mechanical problems, Glassel ordered "abandon ship" and once in the water, he and his stoker Sullivan were pulled out of the water by a Union ship and made prisoner. Tomb, who had remained near the *David*, climbed aboard and, with helmsman Cannon, succeeded in starting the engine. Fighting their way through enemy ships, they returned unharmed to Charleston. The ironclad, however, did not sink. The spar torpedo struck her about seven feet beneath the waterline and along a dividing bulkhead (strong structural beam) that dampened the force of the explosion (Luraghi 1996, 261).

First, the Union sailors believed there was very little damage, but after the removal of the coal, a careful inspection discovered the ironclad had suffered severe damage. A big beam was badly split, the framing of the engine room had cracks four feet long, forty feet of her side had been pushed inward four to five inches, overheads were pushed from their sides by ten feet, and many leaks were discovered. This was just the damage above the keel. Admiral John A. Dahlgren, Commander, Union's South Atlantic Blockading Squadron, saw only one solution, place the ironclad in dry dock as soon as possible (ORN Ser I, 15:17).

The *New Ironsides* was towed to Port Royal, South Carolina, where it was discovered that the damage could not be repaired there; subsequently, she was sent to Philadelphia and remained there for more than a year. The Union Navy kept the extent of the serious damage to the ironclad a tight secret so not to let the Confederates know how devastating their new weapon really was. The disappearance of the eighteen-gun ironclad from the enemy line, however, "confirmed the success of the first mission in history by an assault boat" (Luraghi 1996, 262).

During the first two weeks of January 1864, with Glassel a prisoner of war, James H. Toombs, its former Engineering Officer, took command of the *David*. The following month, the *David* went through an overhaul. Quarter-inch steel was installed on her above-water decking for protection from small arms fire, her spar was replaced, and new controls were placed in her pilot house. Finally, a shield shaped to fit over her smokestack was installed to keep water from putting out her fire as it did in her first attack (Schafer 1996, 100).

On the night of 6 March 1864, the *David* was back in action. With Toombs at the helm and with J. Walker Cannon again acting as pilot, she attacked the USS *Memphis* in the North Edisto River, near Charleston. The attack, carried out just as planned, failed due to the spar torpedo not exploding. Tomb maneuvered the torpedo boat to perform two runs at the Union vessel, but in both runs, the torpedo failed to explode (ORN Ser I, 15:358-359).

A close inspection of the failed torpedo discovered that the glass tube holding the acid had, indeed, shattered, but was defective and therefore did not ignite the ninety-five pounds of gunpowder packed into the warhead. The cause of this fault remains unclear.

Captain Lee believed Tomb had used a defective weapon, not one he made (ORN Ser I, 15:358). Other accounts believed it was due to sabotage. Luraghi writes, "Indeed, the most prominent scholar on Northern espionage, Meriwether Stuart, has proved indisputably that at least two of the most dangerous Northern secret agents succeeded during the war in infiltrating the Confederate torpedo service. Surely the enemy would have spared no effort to strike this awesome branch of the Confederate navy" (Luraghi 1996, 262). A short time later the *David* attempted a third strike on a Union ship. She set out to attack the large Union steam frigate *Wabash.* However, a very rough sea made the task impossible for the small torpedo boat to steer the course necessary to intercept the *Wabash*.

Though the Confederate steamer had failed on her last two attacks, Union officials were keenly aware of the threat to their blockade ships. Admiral John Dahlgren talking about the attack of the *New Ironsides,* claimed, "It seems to me that nothing could have been more successful as a first effort, and it will place the torpedo among certain offensive means" (Dahlgren 1882). Dahlgren also believed, "the 'secrecy, rapidity of movement, control of direction, and precise explosion' made the *Little David* an extremely effective weapon" (Schafer 1996, 102).

Although a lack of suitable machinery and iron plating greatly delayed the building phase, the Confederate Navy, with the help of General Beauregard, proceeded in developing the new offensive weapon. The building of more torpedo boats began and soon two were ready for launching in Charleston. The program extended to other ports, such as Wilmington, North Carolina; Savannah, Georgia; and Mobile, Alabama. In Mobile, the job was given to Lieutenant Colonel Victor von Scheliha, commanding the

engineers in the Gulf of Mexico and authoring the *Treatise on Coast Defence,* a detailed book on coastal defense published in 1868 (Luraghi 1996, 262).

Another torpedo boat built in Virginia near Newport News would have an operational success. The torpedo boat *Squib,* thirty-five feet long, had an explosive device of fifty-three pounds of powder. She was commanded by Hunter Davidson and successfully attacked the big steam frigate *Minnesota* during the night of 9 April 1864, damaging her seriously enough that she was disabled for some time (ORN Ser I, 9:603).

The exact number of torpedo boats produced by the Confederates is unknown but apparently, there were several dozen. After Charleston fell, Rear Admiral Dahlgren wrote: "A torpedo boat, being one of nine found here [Charleston], and of two that were raised by the squadron divers from the bed of the Cooper River, where they had been sunk just before we entered. It was such a boat as this that exploded a torpedo under the *New Ironsides*" (ORN Ser I, 16:339).

Despite all the problems encountered in trying to build the assault boat fleet, the Confederates succeeded in making the torpedo boat effective and feared by Union sailors. Officers and sailors of Union ships, even if protected by antitorpedo nets, were constantly worried about the "deadly boats that hung about them in the darkness, like vultures in search of prey" (Luraghi 1996, 263). Respect for all Confederate torpedo boats also increased. In a letter from Admiral Dahlgren to Secretary of the Navy Gideon Welles, Dahlgren states, "[We should pay] a large reward of prize money for the capture or destruction of a *David.* I should say not less than $20,000 or $30,000 for each. They are worth more than that to us" (Dahlgren 1882).

Success with Submarines

From the beginning of the Civil War, the United States Navy and the Confederate Navy were set on parallel paths of submarine boat development. While vessels like *Pioneer, American Diver, H. L. Hunley* were being built by McClintock and others within the struggling South, similar efforts were being conducted within the Union, such as by Brutus de Villeroi, builder of the *Alligator*, and later the *Intelligent Whale* of Scovel S. Meriam and Oliver Halstead. The initial mission for *Alligator* was to find and sink the ironclad CSS *Virginia*. The Union efforts, however, did not prove themselves as successful as the Confederates did (Compton-Hall 1983, 40).

Submarine development on both sides began in 1861. The submersible development efforts of the United States Navy were slow and less successful than those of the South. One reason for a more rapid progress by the South might have been that while the Union Navy was burdened with eight decades of naval bureaucracy in purchasing and testing, the Confederates use of private initiative met with quick support from a newly formed government not burdened with a standing bureaucracy. Even in this environment, the Confederate Navy Department managed to cause problems when fielding these new war machines. The Confederate Navy also initiated its own submarine program, centered at the Tredegar Iron Works in Richmond, Virginia. However, the program of the Confederate Navy was not as successful as those projects, initiated with private funding (Ragan 1999, 12).

The Union's first attempt at submarine warfare came through a French engineer named Brutus De Vileroy. His boat, named the *Alligator*, was built in Philadelphia. The *Alligator* was forty-seven feet long and made of steel and had a watertight compartment

in the bow that a diver could exit and enter and carried a spar torpedo. Its mode power was a hand crank operated by sixteen men (Stern 1962, 173). A reporter for a Philadelphia newspaper studied the machine and wrote:

> After dropping from a high wharf into a skiff and then jumping a few feet, we found ourselves upon the back of the iron mystery .... The top of the manhole was lifted off, and divesting ourselves of our coat and hat, we squeezed into the machine .... We suddenly found ourselves squatting inside of a cigar-shaped iron vessel, about 4 feet in diameter. There was a crank for the purpose of operating upon the propeller already described, apparatus for steering rods, connected with fins outside, which could be moved at pleasure, and which had something to do with steadying and sinking the craft. There were ... pumps, brass faucets, pigs of ballast lead, and numerous other things, which might be intended for infernal or humane purposes for aught we know. The interior was abundantly lighted by means of the double tier of bull's eyes we have described. (*Philadelphia Evening Bulletin* 17 May 1861)

The Union Navy wanted to use the *Alligator* against the *Virginia* that was being built in Norfolk, but due to delays in construction it was completed too late. The *Virginia* was destroyed by her crew to keep it from being captured while the *Alligator* was being towed from Philadelphia to Chesapeake Bay in June 1862. The *Alligator* was launched but was lost when swamped during a storm. The Union's second attempt at submarine warfare, the *Intelligent Whale*, did not become operational until after the war (Ragan 1999, 258).

The submersible constructions by the Confederates concentrated in four Southern areas. They were: the Tredegar Iron Works in Richmond, Virginia (Coski 1996, 117), Leeds Foundry in New Orleans, Louisiana (Ragan 1995, 18), Park and Lyons Machine Shops in Mobile, Alabama (Perry 1965, 96), and the Confederate naval facilities at Selma, Alabama (Schell 1992, 178). Some Southern submersibles, such as the *American Diver, Hunley* and others, were built either at government facilities or with the assistance of military personnel. This cooperation, however, caused problems for the private

backers of the *Hunley*. In 1863, the Confederate Navy, due to their impatience, seized the *Hunley* with the civilian operators. Nevertheless, this group of entrepreneurs had the most successful submarine venture of the war. Upon the fall of New Orleans and the loss of their first boat the *Pioneer*, some of the members relocated to Mobile where they built and lost a second boat the *American Diver* and ultimately experienced a success off of Charleston with their third boat the *H. L. Hunley*. While researching the three boats built by McClintock's group, their dimensions varied depending on which historical source is used. Table 3 shows just a few sources used during the research. McClintock's descriptions of the boats in his letters to Maury in 1871 and 1872 emerges as being consistently near the mark, while Alexander (who cautioned forty years after the fact that "all dimensions are from memory") seems to be somewhat further off the mark.

A coalition of New Orleans machinists and businessmen formed the submersible shipbuilding program that produced *Pioneer*, *American Diver*, and *H. L. Hunley*. Motivation for them was probably both Southern pride and collecting prize money for destroying Union vessels. The original New Orleans group consisted of machinists Baxter Watson and James McClintock, lawyer and deputy collector of customs Horace L. Hunley, customs house employee and diver John K. Scott, Hunley's wealthy brother-in-law Robert R. Barrow, and prominent lawyer Henry J. Leovy (Schafer 1996, 108; Ragan 1995, 72). These six men were the energy behind the *Pioneer*'s construction at the Leeds Foundry in the winter of 1861-1862. Although, the makeup of this group would change throughout the war, it would be McClintock and Hunley (until his death), who would remain at its core.

Although an alternative to hand power was sought as better means of propulsion, several propulsion systems were experimented with, such as McClintock's electromagnetic drive unit, hand power remained the primary means of propulsion for both the Union and Confederate vessels built during the war. There were three different types of systems for the tactical delivery of the explosive weapon: (1) a time-delay explosive charge (the forerunner of the limpet mine) carried on the outside of the boat and manually placed on the hull of the enemy ship, like Bushnell's *Turtle*; (2) a contact torpedo towed behind the submarine and detonated by the charge beneath the target and surface on the other side so the charge would collide with the target; (3) and the bow-mounted spar torpedo concept originated by Fulton. McClintock's series of boats would utilize all three of these methods (Luraghi 1996, 254).

The private Confederate initiative was predominately spurred by motives of both nationalism and profit. Privateering, reinstated by the Confederate government, tapped into both sentiments. One of the approximately fifty Confederate privateers authorized by the government was James McClintock and Baxter Watson's New Orleans-built *Pioneer*, which was the prototype for the *H. L. Hunley*. The *Pioneer* had the distinction of being the only submersible provided with a letter of marque and reprisal by the Confederate States (see Figure 19).

The *Pioneer*, built in the Leeds Foundry in New Orleans, was equipped with diving planes and armed with a clockwork torpedo carried on top of the submarine to be screwed into the bottom of an enemy's ship. In a postwar letter sent by McClintock to Matthew Maury in 1871, he describes his first attempt with an underwater vessel as:

> In the years 1861, 62, and 63, I in connection with others was engaged in inventing and constructing a submarine boat or boat for running under the water at any required depth from the surface. At New Orleans in 1862 we built the first boat, she was made of iron 1/4 inch thick. the boat was of a cigar shape 30 feet long and 4 feet in diameter. This boat demonstrated to us the fact that we could construct a boat that would move at will in any direction desired, and at any distance from the surface. As we were unable to see objects after passing under the water, the boat was steered by a compass, which at times acted so slow, that the boat would at times alter her course for one or two minutes before it would be discovered, thus losing the direct course and so compel the operator to come to the top of the water more frequently than he otherwise would. (McClintock undated)

The *Pioneer* launched in February 1862 at the government yard at New Basin and taken up the New Canal, underwent trials in Lake Ponchartrain. According to McClintock, during this trial, the boat sank a schooner and several target barges by means of a towed torpedo (Perry 1965, 95). On 29 March 1862 John K. Scott, the ship's captain, submitted an application for a letter of marque and reprisal. On March 31 the letter of marque was approved and issued under the authorization of Confederate Secretary of State Judah P. Benjamin. It sites the vessel's name as *Pioneer* and the vessel type as a "submarine propeller" armed with a "magazine of powder." The *Pioneer* described as measuring thirty-four feet in overall length, four feet in beam, drawing four feet of water, and weighing four tons. It was painted black and had round conical ends. The number of crew required to operate the hand crank for propulsion was two, plus John K. Scott as the vessel commander (Ragan 1999, 49). However, the *Pioneer* was never used in the war. A month after the issuance of the letter of marque, New Orleans fell to Union forces, and her builders scuttled the *Pioneer* to prevent it from falling into the hands of the enemy.

While the Union occupied New Orleans, the *Pioneer* was discovered, and a study was conducted by two U.S. Navy engineers, Lieutenants Alfred Colin and George W. Baird of the USS *Pensacola*'s engineering department. Baird writes:

> The boat was built of iron cut from old boilers, and was designed and built by Mr. McClintock.... She was thirty feet in length; the middle body was cylindrical, ten feet long, and the ends were conical. She had a little conning tower with a manhole in the top, and small, circular, glass windows in its sides. She was propelled by a screw, which was operated by one man. She had vanes, the functions of which were those of the pectoral fins of a fish. The torpedo was of a clockwork type, and was intended to be screwed into the bottom of the enemy's ship. It was carried on top of the boat, and the screws employed were gimlet-pointed and tempered steel.
>
> Mr. McClintock (whom I met after the Civil War had ended) informed me that he had made several descents in his boat, in the lake, and succeeded in destroying a small schooner and several rafts. He stated that the U.S. Steamers "New London" and "Calhoun" had been a menace on the lake, and this gave rise to the torpedo boat; but before an attack was made the fleet of Farragut had captured New Orleans, and his boat was sunk to prevent her from falling into the hands of the enemy. (Baird 1902, 845-846)

This documentation also included a drawing of the boat (figure 20). After the fall of New Orleans, McClintock, Watson, and Hunley traveled to Mobile to continue their quest to build an underwater machine that would help break the blockade.

Arriving in Mobile, McClintock, Watson, and Hunley joined efforts with engineers Thomas Park and Thomas Lyons of the Park and Lyons machine shops where they would build their new boat called the *American Diver* or *Pioneer II* depending on the source. The group now began to receive support from the Confederate military. Lieutenant William Alexander, CSA, an engineer detached from the Twenty-First Alabama Volunteer Regiment and detailed to duty at Park and Lyons after surviving the bloody battle of Shiloh. Alexander, a British-born, expert machinist, migrated to Alabama in 1859. He received orders to stop work on all other projects in order to devote

all his time to McClintock's submarine (Ragan 1995, 22). The plans called for a larger boat than the *Pioneer*. In a letter to Maury, McClintock reveals the original intention to build a boat that was self-propelled by an energy source of the future, an electric engine:

> To obtain room for the machinery and persons, she was built 36 feet long, 3 feet wide, and 4 feet high, 12 feet at each end was built tapering or modeled to make her easy to pass through the water. There was much time and money lost in efforts to build an electromagnetic engine for propelling the boat.... I afterwards fitted cranks to turn the propeller by hand, working four men at a time, but the air being so closed, and the work so hard, that we were unable to get a speed sufficient to make the boat of service against vessels, blockading the port. (McClintock u.d.)

It was the first time in history to attempt to use a magnetic engine on this scale. The engine was like a reverse magnet. Instead of converting mechanical energy to electrical, it did the opposite. This type of engine was a precursor to electric engines that would be used several years later (Luraghi 1995, 253).

Unfortunately, the electric motor was a failure because it could not produce the kind of energy required to power the vessel. McClintock then mounted a custom-built steam engine in the submarine, but it also was a failure (Ragan 1995, 22). The engine was removed, and a propeller shaft, designed to turn by four men, was installed, (figure 21). By mid-January 1863, the *American Diver or Pioneer II* was ready for sea (Ragan 1995, 24). Admiral Franklin Buchanan, in charge of the Mobile's naval defense, corresponded with Secretary of the Navy, C.S.A., Stephen R. Mallory concerning the *American Diver or Pioneer II.* From this letter, it is clear that the boat did not perform as hoped. In a letter dated 14 February 1863, he outlines her effectiveness:

> Sir: I have the honor to acknowledge the receipt of your letter of the 27th relating to Mr. McClintock's submarine boat. Mr. McClintock has received from this state, from General Slaughter commanding her, and myself all the assistance and facilities he requested to complete his boat, and within the last week or ten

> days we succeeded in getting a man from New Orleans who was to have made the "magnetic engine" by which it was to have been propelled. I have witnessed the operations of the boat in the water when propelled by hand, the steam engine being a failure and had to be removed.
>
> On that occasion it's speed was not more than two miles per hour. Since then other trials have been made all proving failures. The last trial was made about a week since when the boat was lost off this harbor and was sunk, the men came very near being lost. (Buchanan Letter Book 1863)

Although the *American Diver or Pioneer II* had a less than successful trial, she was rigged with a torpedo and attempted an attack on an enemy ship. "It was towed off Fort Morgan, intending to man it there and attack the blockading fleet outside, but the weather was rough, and with a heavy sea the boat became unmanageable and finally sank, but no lives were lost" (Alexander1902, 165). The waves were breaking over her deck and water flowed through the manholes left open for ventilation. The crew tried to pump the water out but the boat settled deeper until it finally rolled over and sank.

The hope of raising the *American Diver or Pioneer II* was eventually abandoned. The exact location has long since been forgotten and still lays somewhere in the middle of Mobile Bay. Not being discouraged, with Admiral Buchanan's backing, the McClintock group went back to work. First, they secured new financial support by selling shares to members of the Singer Submarine Corps, composed of engineers E. C. Singer, B. Gus Whitney, R. W. Dunn, and J. D. Breaman (Duncan 1965, 64), and then started working on plans for a new and improved submarine.

McClintock and Alexander, back at Park and Lions machine shop, began construction on their third and final boat. Lieutenant Alexander was joined by another Army assignee to the machine shop, his friend Lieutenant George Dixon, CSA (Dixon was actually a Kentuckian). Dixon and Alexander served together in the Twenty-First

Regiment at Shiloh, where Dixon sustained a serious leg wound (Ragan 1995, 28). The group obtained a long-cylindrical steam boiler, which they lengthened, deepened, and fitted out to accommodate a maximum crew of nine (figure 22). Alexander writes in 1902:

> We decided to build another boat, and for this purpose took a cylinder boiler which we had on hand, 48 inches in diameter and 25 feet long (all dimensions are from memory). We cut this boiler in two, longitudinally, and inserted two 12-inch boiler-iron strips in her sides; lengthened her by one tapering course fore and aft, to which were attached bow and stern castings, making the boat about 30 feet long, 4 feet wide, and 5 feet deep. A longitudinal strip 12 inches wide was riveted the full length on top. At each end a bulk-head was riveted across to form water-ballast tanks (unfortunately these were left open on top); they were used in raising and sinking the boat. In addition to these water tanks the boat was ballasted by flat castings, made to fit the outside bottom of the shell and fastened thereto by "Tee" headed bolts passing through stuffing boxes inside the boat, the inside end of bolt squared to fit a wrench, that the bolts might be turned and the ballast dropped, should the necessity arise (Alexander 1902, 165-166).

The dimensions given by Alexander were in line with most other accounts of the *Hunley*, but this is probably due to the fact he was writing from memory almost thirty years after the fact. The elusion to the ballast tank's lack of seal at the top possibly refers to problems that could have occurred with a faulty sea cock that allows water into the tank. Alexander continues to describe the *Hunley*:

> In connection with each of the water tanks there was a sea-cock open to the sea to supply the tank for sinking; also a force pump to eject water from the tanks into the sea for raising the boat to the surface. There was also a bilge connection to the pump. A mercury gauge, open to the sea, was attached to the shell near the forward tank, to indicate the depth of the boat below the surface. A one and a quarter shaft passed through stuffing boxes on each side of the boat, just forward of the end of the propeller shaft. On each side of this shaft, outside of the boat, castings, or lateral fins, five feet long and eight inches wide, were secured. This shaft was operated by a lever amidships, and by raising or lowering the needs of these fins, operated as the fins of a fish, changing the depth of the boat below the surface at will, without disturbing the water level in the ballast tanks. (Alexander 1902, 166)

Unlike *Hunley's* predecessor, her design incorporated a hand crank for motive power from the planning stage. It also had other innovated designs, such as a propeller guard and from past experience. It was learned the submarine would tilt to one side whenever a single member of the crew would make the slightest move. To alleviate this problem, the submarine, balanced in a way, each crewmember was assigned an exact spot on the hand crank so the boat would not react to their small movements.

> The boat was operated by manual power, with an ordinary propeller. On the propelling shaft there were formed eight cranks at different angles; the shaft was supported by brackets on the starboard side, the men sitting on the port side turning the cranks. The propeller shaft and cranks took up so much room that it was very difficult to pass fore and aft, and when the men were in their places this was next to impossible. In operation, one-half the crew had to pass through the fore hatch; the other through the after hatchway. The propeller revolved in a wrought iron ring or band, to guard against a line being thrown in to foul it. There were two hatchways--one fore and one aft--16 inches by 12, with a combing 8 inches high. These hatches had hinged covers with rubber gasket, and were bolted from the inside. In the sides and ends of these combings glasses were inserted to sight from. There was an opening made in the top of the boat for an air box, a casting with a close top 12 by 18 by 4 inches, made to carry a hollow shaft. This shaft passed through stuffing boxes. On each end was an elbow with a 4 foot length of 1 1-2 inch pipe, and keyed to the hollow shaft; on the inside was a lever with a stop-cock to admit air. (Alexander 1902, 166)

The boat launched on July 1863 at Mobile's Theater Street dock. At this point, before Hunley's death and the subsequent naming of the vessel for him, the vessel was referred to by several different names, including "the Fish Boat" (Fort 1914; Stanton 1914) and "the Porpoise" (Ragan 1995, 42). Whatever name used, the trials produced pleasing results. Admiral Franklin Buchanan noted in a letter to Charleston's Naval Commander, John Tucker:

> Naval Commandant's Office Mobile, Ala. August 1st, 1863. Sir: I yesterday witnessed the destruction of a lighter or coal flat in the Mobile River by a torpedo which was placed under it by a submarine iron boat, the invention of Messrs. Whitney and McClintock; Messrs. Watson and Whitney visit Charleston for the

> purpose of consulting General Beauregard and yourself to ascertain whether you will try it, they will explain all its advantages, and if it can operate in smooth water where the current is not strong as was the case yesterday. I can recommend it to your favorable consideration, it can be propelled about four knots per hour, to judge from the experiment of yesterday. I am fully satisfied it can be used successfully in blowing-up one or more of the enemy's ironclads in your harbor. Do me the favor to show this to General Beauregard with my regards. Very Respectfully Franklin Buchanan Admiral CSN (Buchanan Letterbook 1863).

After the successful trials in Mobile, it was decided to ship the *Hunley* by rail on two, twenty-foot flatcars (see figure 23), to Charleston, South Carolina, to try and break the Union blockade.

There were four possible reasons to move the *Hunley* to Charleston. The first, Charleston was under a greater siege than Mobile. Second, businesses in Charleston were offering great sums of money for anyone destroying a vessel in the Union's blockading fleet. Third, Charleston's coastal waters were a more desirable operating environment for the *Hunley*. Finally, because General Beauregard in Charleston had a more favorable outlook on unconventional weapons. The actual reason for the move was probably a combination of two or more of the above possibilities that ultimately enticed the *Hunley* to Charleston. Once there, the *Hunley* endured several deadly mishaps while preparing to attack the Union blockaders as well as several changes to the torpedo delivery system.

The submarine arrived in Charleston on 12 August 1863, within a few days the boat was launched, refitted, and armed with a newly built singer torpedo. After several night excursions by the *Hunley* were uneventful and the siege of Charleston becoming more intense with midnight bombardments of the city with Union ironclads in the Bay, the military grew impatient with the civilian owner and operators of the submarine and

seized it (Ragan 1995, 54). Once seized and the civilian crew replaced by Confederate Navy personnel, the boat was twice accidentally lost in Charleston Harbor with fatalities, following both times it was subsequently salvaged. The first incident killed five of the nine crewmembers, most of whom were volunteers from the CSS *Chicora* and CSS *Palmetto State*. Lieutenant C. L. Stanton, CSN provides background:

> One day when Lieutenant Payne, my friend and shipmate, was aboard the *Chicora* I arranged to go down under the water with him; but as the boat was obliged to leave before my watch on deck was over, Lieutenant Charles H. Hooker [*sic*, Hasker] took my place. She dived about the harbor successfully for an hour or two and finally went over to Fort Johnson, where the little steamer *Etiwan* was lying alongside the wharf. She fastened to her side with a light line with the fins in position for diving. Both manheads were open. Payne was standing on top of the fishboat, and Lieutenant Hooker's [sic, Hasker] body was halfway through the forward manhole. (Stanton 1914, 398)

Lieutenant Charles H. Hasker, CSN (a former boatswain on the CSS *Virginia* during the Battle of Hampton Roads) was immediately behind Payne in the lead cranksman's position at the time of the accident. His account of that day, relayed through his friend W. B. Fort in a 1918 article in *Confederate Veteran,* stated:

> We were lying astern of the steamer *Etowah* [anouther name for the CSS *Etiwan*], near Fort Johnson, in Charleston Harbor. Lieutenant Payne, who had charge, got fouled in the manhole by the hawser and in trying to clear himself got his foot on the lever which controlled the fins. He had just previously given the order to go ahead. The boat made a dive with the manholes open and filled rapidly. Payne got out of the forward hole and two others out of the aft hole. Six of us went down with the boat. I had to get over the bar which connected the fins and through the column of water which was rapidly filling the boat. The manhole plate came down on my back; but I worked my way out until my left leg was caught by the plate, pressing the calf of my leg in two. Held in this manner, I was carried to the bottom in forty-two feet of water. When the boat touched bottom I felt the pressure relax. Stooping down, I took hold of the manhole plate, drew out my wounded limb, and swam to the surface. Five men were drowned on this occasion. (Fort 1914, 459)

Payne and Hasker escaped through the forward hatch, while the team's explosives expert Charles L. Sprague and another unidentified crewmember managed to escape through the aft manhole. Five volunteer crewmen from the *CSS Chicora* and *Palmetto State* were carried to the bottom and drowned (Ragan 1995, 54).

Following this tragedy, Horace L. Hunley wrote a letter to General Beauregard requesting to "place the boat in my hands to furnish a crew (in whole or in part) from Mobile" (Hunley 1863). The crew he brought was Thomas Park's son Thomas W. Park and approximately six or so other volunteers, probably mechanics from the Park and Lyons shop. They spent some time putting the boat through diving and raising tests, possibly for the purpose of testing a new adjusted compass (Ragan 1995, 66). When it finally appeared that the vessel had its required experienced hands, the boat suffered another terrible disaster.

While running submerged, Hunley, acting as vessel commander, made a simple error in regulating the water in the forward ballast tank, and the boat buried its bow in the harbor mud and partially flooded, killing the entire crew of eight including Hunley and Sprague (who narrowly escaped the first accident). The *Journal of Operations* in Charleston dated 15 October 1863 stated:

> Raining again this morning, and too hazy to get report of the fleet. An unfortunate accident occurred this morning with the submarine boat, by which Captain H. L. Hunley and 7 men lost their lives in an attempt to run under the navy receiving ship. The boat left the wharf at 9:25 a. m. and disappeared at 9:35. As soon as she sunk air bubbles were seen to rise to the surface of the water, and from this fact it is supposed the hole in the top of the boat by which the men entered was not properly closed. It was impossible at the time to make any effort to rescue the unfortunate men, as the water was some 9 fathoms deep. (ORN Ser 1, 15:692)

Divers hired to locate and rig the boat for salvage found it buried bow first in the mud. Alexander's insightful reconstruction of the accident gives details of the crew's standard operating procedures:

> The position in which the boat was found on the bottom of the river, the condition of the apparatus discovered after it was raised and pumped out, and the position of the bodies in the boat, furnished a full explanation for her loss. The boat, when found, was lying on the bottom at an angle of about 35 degrees, the bow deep in the mud. The bolting-down bolts of each hatch cover had been removed. When the hatch covers were lifted considerable air and gas escaped. Captain Hunley's body was forward, with his head in the forward hatchway, his right hand on top of his head (he had been trying, it would seem, to raise the hatch cover). In his left hand was a candle that had never been lighted, the sea-cock on the forward end, or `Hunley's' ballast tank, was wide open, the cockwrench not on the plug, but lying on the bottom of the boat. Mr. Park's body was found with his head in the after hatchway, his right hand above his head. He also had been trying to raise the hatch cover, but the pressure was to great. The sea-cock to his tank was properly closed, and the tank was nearly empty. The other bodies were floating in the water. Hunley and Parks were undoubtedly asphyxiated, the others drowned. The bolts that held the iron keel ballast had been partly turned, but not sufficient to release it.
>
> In the light of these conditions, we can easily depict before our minds, and almost readily explain, what took place in the boat during the moments immediately following its submergence. Captain Hunley's practice with the boat had made him quite familiar and expert in handling her, and this familiarity produced at this time forgetfulness. It was found in practice to be easier on the crew to come to the surface by giving the pumps a few strokes and ejecting some of the water ballast, than by the momentum of the boat operating on the elevate fins. At this time the boat was under way, lighted through the deadlights in the hatchways. He partly turned the fins to go down, but thought, no doubt, that he needed more ballast and opened his sea-cock. Immediately the boat was in total darkness. He then undertook to light the candle. While trying to do this the tank quietly flooded, and under great pressure the boat sank very fast and soon overflowed, and the first intimation they would have of anything being wrong was the water rising fast, but noiselessly, about their feet in the bottom of the boat. They tried to release the iron keel ballast, but did not turn the keys quite far enough, and therefore failed. The water soon forced the air to the top of the boat and into the hatchways, where captains Hunley and Parks were found. Parks had pumped his ballast tank dry, and no doubt Captain Hunley had exhausted himself on his pump, but he had forgotten he had not closed his sea cock. (Alexander 1902, 168-170)

The handling of the temperamental new boat took a highly trained individual to ensure all the small but vital actions were accomplished to successfully lower and then raise the submarine. Researcher Mark Ragan described the operation:

> The skipper … stood in the forward hatch, peering through small glass view ports located at the front and sides of the narrow conning tower. In one hand was the lever that controlled the port and starboard diving planes. In the other, he grasped the wheel that manipulated the rudder. When running submerged, it was he who knelt next to the candle, monitoring the dimly lit depth gauge and compass …. When the cabin's oxygen was nearly exhausted, it was he who manually pumped out the forward ballast tank, causing the craft to rise to the surface …. Without a doubt, it can be said that the fate of every man on board was in the hands of this man at the forward hatch. (Ragan 1995, 29-30)

McClintock's caution with the boat may have gone a little overboard, but in hindsight, it appears justified in light of the two fatal tragedies that transpired. Both accidents were attributable, in some way, to personal errors on the part of the vessel commanders. In Payne's case, the result was the loss of five crewmen, and Hunley's actions resulted in not only his own death but also his entire crew.

Fifteen years after the second accident, General Beauregard's remembrance of the events surrounding the recovery of the boat and crew three weeks after the sinking was still graphic in his mind when writing his letter published in the *Southern Historical Society Paper* in 1878:

> Lieutenant Dixon made repeated descents in the harbor of Charleston, diving under the naval receiving ship which lay at anchor there. But one day when he was absent from the city Mr. Hunley, unfortunately, wishing to handle the boat himself, made the attempt …. When the boat was discovered, raised and opened, the spectacle was indescribable and ghastly; the unfortunate men were contorted into all kinds of horrible attitudes; some clutching candles, evidently endeavoring to force open the man-holes; others lying on the bottom tightly grappled together, and the blackened faces of all presented the expression of their despair and agony. After this tragedy I refused to permit the boat to be used again; but Lieutenant Dixon, a brave and determined man, having returned to Charleston, applied to me for authority to use it against the Federal steam sloop-of-war *Housatonic*, a

> powerful new vessel, carrying eleven guns of the largest calibre, which lay at the time in the north channel opposite Beach Inlet, materially obstructing the passage of our blockade-runners in and out. (Beauregard 1878, 153-154)

His letter also gave insight to the next episode of the *Hunley's* history.

Upon the salvage of the boat, Dixon and Alexander enlisted another volunteer crew and moved their operations to Battery Marshall, on Sullivan's Island, where between November 1863 and February 1864 they reconfigured the torpedo delivery system and fought foul weather in the waters off Charleston (Ragan 1995, 118). During this time, Dixon and Alexander also established the first school for submariners to teach their new crew of volunteers the complete workings of the *Hunley*. Because of the realization that the skipper of the vessel had such a vital role in the success of a mission, Alexander and Dixon explained:

> how their boat worked, each man would have taken a turn at the skipper's station and been briefed as to the function of the diving planes and ballast tanks. Each would have turned the wheel that caused the long rods over the crew's heads to move in and out the stern stuffing boxes causing the vessel's rudder to turn. The function of the mercury gauge explained as to how it enabled the helmsman to regulate the depth of the submarine. The men would then have taken their places for a mock dive while still safe on the wharf." (Ragan 1995, 90)

The group then undertook the first change to the torpedo. Alexander indicated that the towed torpedo arrangement proved unworkable, stating:

> The torpedo was a copper cylinder holding a charge of ninety pounds of explosive, with percussion and friction primer mechanism, set off by flaring triggers. It was originally intended to float the torpedo on the surface of the water, the boat to dive under the vessel to be attacked, towing the torpedo with a line 200 feet long after her, one of the triggers to touch the vessel and explode the torpedo, and in the experiments made in the smooth water of Mobile River on some old flatboats these plans operated successfully, but in rough water the torpedo was continually coming too near the wrong boat. We then rigged a yellow pine boom, 22 feet long and tapering; this was attached to the bow, banded and guyed in each side. A socket on the torpedo secured it to the boom. (Alexander 1902, 167)

After this first modification, as fate would have it, Alexander received orders to report to another project, so the fate of the *Hunley* and her crew rest in the capable hands of Lieutenant Dixon of Alabama. The final adjustment to the spar torpedo system came on 17 February 1864, "Lieutenant Dixon landed and requested that two of my regiment, the 23rd South Carolina Volunteers, go aboard and help them to adjust the machinery, as it was not working satisfactorily. Another man and I went aboard and helped propel the boat for some time while the Lieutenant and others adjusted the machinery and the rods that held the torpedo and got them to working satisfactorily." (McClaurin 1925, 328) On that same day, a recognition signal using a blue lamp was arranged by Dixon and the men of the Battery Marshall to help guide the boat back after dark, "The day of the night the perilous undertaking was accomplished, the little war vessel was taken to Breach Inlet. The officer in command [Dixon] told Lieutenant-Colonel Dantzler [in command of Battery Marshall] when they bid each other good-by, that if he came off safe he would show two blue lights" (Cardozo 1866).

That evening, 17 February 1864, Dixon took the helm of the *Hunley* and set out on patrol looking for a Union's blockading ship, primarily the *Housatonic*. Approximately 2 1/2 miles off Charleston Bar, the *Hunley* saw and changed course toward the screw sloop-of-war USS *Housatonic*, at anchor on blockade duty. The *Housatonic*'s lookout spotted the *Hunley* and shouted a warning, but the ship's attempt to get underway was not quick enough to avoid the contact with the spar torpedo. The *Housatonic* sank in about three minutes. The board of inquiry, convened to inquire into the *Housatonic*'s loss, provides details regarding the *Hunley*'s historic attack. The officer of the Deck on the eight-to-twelve watch, related the following:

> I took the deck at 8 P.M. on the night of February 17th. About 8:45 P.M. I saw something in the water, which at first looked to me like a porpoise, coming to the surface to blow. It was about 75 to 100 yards from us on our starboard beam. The ship heading northwest by west 1/2 west at the time, the wind two or three points on the starboard bow. At that moment I called the Quartermaster's attention to it asking him if he saw anything; he looked at it through his glass, and said he saw nothing but a tide ripple in the water. Looking again within an instant I saw it was coming toward the ship very fast. I gave orders to beat to quarters slip the chain and back the engine, the orders being executed immediately. (Crosby 1864)

The *Housatonic* took five of its crew to the bottom when she sank. However, the price was high for the submersible's tactical victory. The *Hunley* and its crew never returned to Sullivan's Island, although the prearranged lamp signals were believed to have been received from Dixon by the crew ashore (*ORN* I, 15:335). The disappearance of the *Hunley* became one of the war's greatest mysteries and mostly remains unsolved. There are a number of theories regarding when, where, and why the boat was lost. One piece of the puzzle, however, is known. The wreck was relocated in 1995 by archaeologists Ralph Wilbanks, Wes Hall, and Harry Pecorelli III of best-selling author Clive Cussler's National Underwater Marine Agency (NUMA). The questions of when and why the *Hunley* went down will not be answered until, if ever, the ship is raised.

The Confederate submarine operations, specifically the *H. L. Hunley*'s successful engagement of *Housatonic*, had several significant effects on U.S. Navy operations. The new underwater operations were a powerful pyschological warfare tool, causing fear among the South Atlantic Blockading Squadron following the *Hunley*'s action as evident in a letter sent to Dahlgren from the commander: "U. S. S. *New Ironsides*, off the Morris Island, S. C., 23 February 1864. Sir: since the '*Housatonic*' was sunk, the only picket boat that has reported for duty is that of the '*Supply*'" (Commanding Officer, *USS New*

Ironsides 1864). They caused expensive and logistical modifications to Union blockading strategies by causing heightened security in the vessels on station, requiring them to be ready to get underway at any time and forcing them to be redeployed further offshore at night which allowed a greater possibility for blockade runners to get through to that besieged city. Admiral Dahlgren, USN, writes:

> Flag-Steamer *Philadelphia*, Port Royal Harbor, S.C., February 19th, 1864. The *Housatonic* has just been torpedoed by a rebel *David*, and sunk almost instantly. It was at night and water smooth. The success of this undertaking will, no doubt, lead to similar attempts along the whole line of the blockade.
>
> If vessels on the blockade are at anchor they are not safe, particularly in smooth water, without outriggers and hawsers stretched around with rope netting dropped into the water. Vessels on inside blockade had better take post outside at night and keep underway, until these preparations are completed.
>
> All the boats must be on the patrol when the vessel is not in movement. The commanders of vessels are required to use their utmost vigilance -nothing less will serve. I intend to recommend to the Navy Department the assignment of a large reward as prize money to crews of boats or vessels who shall capture, or beyond doubt destroy, one of these torpedoes. (ORN Ser. I, 15:330)

Although, the Admiral called the *Hunley* "*David*," confusing it with the semi-submersible, his fears were very clear.

Finally, they may have provided the reason for accelerated United States attempts to gather intelligence on such craft, conduct their own research, and develop similar weapons. Although such attempts had been underway as early as 1861, it was the *Hunley*'s attack on the *Housatonic* that illustrated to the U.S. Navy the danger of the submersible torpedo craft and demonstrated to the world the vast potential of the submersible vessel in future naval strategy.

CHAPTER SIX

CONCLUSION

> I am satisfied that, with the means at our control and in view of the overwhelming force of the enemy at the outset of the struggle, our little navy accomplished more than could have been looked or hoped for; and if I have ever felt any surprise connected with its operations, it was that we accomplished so much. Our Navy alone kept those of the United States from reaching Richmond by the James river, and from reaching Savannah and Charleston; and yet, not ten men in ten thousand of the country, knew or appreciated these facts. (Mallory 1867)

Stephen Mallory, Confederate Secretary of the Navy, was the guiding force behind the Confederate naval strategy and ultimately the makeup of the Confederate Navy. Therefore, Mallory directly or indirectly influenced every aspect of this thesis. The innovation and the use of new found technology, in some cases, were not just born out of necessity, as some historians would lead one to believe, but out of visionary thinking by men, such as Stephen Mallory. While serving on the congressional Committee on Naval Affairs as a United States senator from Florida, Mallory saw that iron-plated ships were the natural progression for the world navies in the 1840s and 1850s. What Mallory needed, he believed, were technological innovations that could tip the scales in the Confederates' favor. Breakthroughs in the areas of armored ships, powerful naval guns, submarines, and torpedo warfare could possibly give the Confederates the edge they needed.

Whether one agrees or not with the methodology in which Mallory implemented his technologically based naval strategy can be debated for the next one hundred years. The facts remain, his adversary was able to buy or build over 600 warships, including

313 wooden steamers and about 65 ironclads (Anderson 1962, 290) while Mallory obtained around 130 warships, of which 24 were ironclads (Anderson 1962, 300). While being out numbered six to one, Mallory was able to hold off the overwhelming power of his enemy for four years, and at wars end, only one of the six major Southern sea ports was lost from the sea (Luraghi 1996, 346).

The use of technology significantly influenced the Confederate Navy's strategic, operational, and the tactical levels of war. Operational campaigns were planned and executed around the presence or absence of Confederate ironclads by both the North and the South. Battles were won, lost, or never fought due to the presence of Confederate torpedoes laid in Southern harbors defending vital ports for Confederate commerce. The threat of Confederate submarines caused Union blockading squadrons to reduce the capabilities of catching runners by moving the fleet out of the submarines tactical range.

The Confederate naval strategy was influenced, or more accurately stated, forced by two factors: Jefferson Davis' war strategy and the Union's naval strategy. The Confederate war strategy was an "offensive-defensive" strategy that dispersed the Army to several key points across the northern perimeter of the Confederacy. The Northern naval strategy, at first, was straightforward: a naval blockade of every major seaport in the South. The next phase of the Northern naval strategy was started at the end of 1861 with a major amphibious invasion by Union troops along the Southern Atlantic coast.

Therefore, the Confederate naval strategy was sealed. It had to be defensive in nature, protecting thirty-five hundred miles of coasts, in particular the major seaports and logical landing sites and while at the same time breaking the blockade that was strangling the South of greatly needed imports. It is important to note the naval strategy of the

North, and therefore the South, changed through the early years of the war. The two phases of the Confederate naval strategy were not initially adopted, but evolved over time. The only thing left for Mallory to decide upon was how to brake the blockade and provide defense to the vast Southern coastline.

As stated above, this decision was relatively easy for Mallory. In the initial phase, his "technological surprise" was fourfold: armored ships, rifled naval guns, fast steam ships for commerce raiding, and submarine weapons. The second phase of his plan did not change the technology used, just how it was employed.

The use of commerce raiding to try to draw blockading ships off the Southern coasts to protect merchant shipping and its effects on northern commerce, although not discussed in this thesis, disserves mentioning here. Another means in which Mallory used the new technologies of the day was by steam cruisers built specifically for raiding merchant vessels on the open ocean. To execute this part of his strategy he would use eleven fast, highly maneuverable steam cruisers, with the best of these bought from England. The three from England were the *Alabama*, *Shenandoah*, and *Florida*.

The exploits of Admiral Rafael Semmes and *CSS Alabama* with the other fast steam cruisers were daring and highly successful. During the war, commerce raiding was responsible for keeping approximately 120,000 tons of goods with worth of $20,000,000 from arriving in the North. These cruisers operated all over the world and led to victories on the high seas that were looked upon as illustrations of great hope by many Southerners. In the end, however, commerce raiding had little or no effect on Mallory's strategic objectives or on the war. The amount of goods that raiding could keep from the North would never be anything more than an annoyance. Mallory's hope that raiding

would draw Union ships from the blockading squadrons never materialized either. The United States Naval Secretary, despite outcries from the public, realized that his number one priority had to be the blockade (Fowler 1990 298-299).

In addition to steam cruisers, rifled guns, though somewhat covered in conjunction with the ironclads, were not explored in depth. Therefore, the technology the Confederates used, as relates to this thesis was: the production of iron-plated ships and how to balance the tradeoffs between tonnage (armor and armament), speed, and seaworthiness; electrical and chemical improvements in mine warfare; and underwater breakthroughs in submarine warfare. These new "weapons" would not only have a mark in naval history of the Civil War, but were true precursors to the present day United States Mine Warfare Command, submarine fleet, and the battleships that won their glory in two world wars. The political and economic conditions in the South, however, had a significant role in Mallory's quest to build a technologically superior naval fleet.

The political environment in the South was not conducive to having a strong central government, which is essential when trying to build an arm of the armed forces to protect a country made up of several independent states. Mallory had to deal or to negotiate with individual governors of several states in order to develop and implement his naval strategy. He also had to negotiate with these same governors for raw materials to build the fleet to execute his new plan. Every state obviously had their own agenda, some of which was not necessarily in line with Mallory's and therefore, the central governments. To make matters worse, these state governors, while ignoring the central government in many respects, were using the newly formed Confederate Congress, by

way of their state representative, to exert enormous pressure on Jefferson Davis and his Cabinet.

The economic and industrial conditions in the South also had a devastating impact on Mallory's technologically based navy. The lack of money caused countless delays in the ironclad procurement and building programs and caused private entrepreneurs to dominate the submarine program throughout the war. The South lacked the industrial plants, resources, and skilled workers, which were all abundant in the North. Therefore, Mallory's grand scheme of a small, technologically advanced navy that could break the blockade and deliver the decisive blow to the enemy while protecting the South's vast coastline could not be realized.

The use of a technological based naval strategy by Mallory. however, was a successful endeavor, in one degree or another. All facets of his strategy, if not completely successful in its intent, had a positive influence on the overall strategy, causing the Union Navy, and in some cases the Army, to change plans, slow operational tempo, and cancel operations all together. Ironclads, although unable to break the Union blockade as Mallory had first intended, altered the operational plans of Union Army commanders and held Union warships at bay in several crucial Southern harbors. The early adoption of defensive mining greatly enhanced the defense of major ports and coastal harbors in the South. The use of semisubmersible and submersible boats as an offensive means of delivering mines struck fear in all Union sailors and caused them to alter the blockading strategy and use less than optimal tactics.

When put in the context of harbor defense, the Confederate ironclad was an effective weapon. The mere presence of the *Virginia* on the James River caused General

McClellan to make drastic changes in his plans to attack Richmond, known as the Peninsular Campaign. After the Virginia's battle at Hampton Roads, she remained there and blocked the James River. This caused General McClellan to move his army down the York River, north side of the peninsula, and use a very slow, swampy approach to Richmond. In addition, the Union Navy, due to its concern about the *Virginia*, refused to transfer any ships away from Hampton Roads to support McClellan. Due to the lack of transport vessels on the York, McClellan's army bogged down in the mud and the Confederate force at Yorktown. McClellan finally made his way across the peninsula, fighting in the Seven Days' Battles, but was no closer to Richmond than when he started. Therefore, "the campaign then ended, a brilliant strategic scheme partially frustrated by one warship" (Reynolds 1974, 385-386). This is but one account of many operational and tactical plans that were altered, delayed, or cancelled due to the presence of a Confederate ironclad.

The fact that the ironclad program accomplished what it did is truly amazing. The lack of raw material in the South would be made a major hindrance in itself. Coupled with the lack of facilities to roll the iron and the workmen to cut and fasten it to the ships almost made it impossible. One might question Mallory's concept of basing most of his strategy on a ship class that took materials that were not easily accessible to his country. However, to his credit, Mallory was able to produce twenty-four ironclads at a time his advisors were telling him he could not produce one (Still 1974, 12). In a letter written to the chairman of the Senate Naval Affairs Committee, Mallory defends his ironclad program by stating:

> Though the enemy has for two years had a formidable fleet of heavy ships... [including] seven Monitors, off the port of Charleston, with ability in speed and power at all times of night to pass the batteries, obstructions and forts, and to go to the wharves of the city, it was never attempted. Our three ironclads - moveable forts--with formidable batteries ... were ever present in the harbor with steam up, ready for action .... But for them the enemy would have taken [the city] .... The same view may [be had] with reference to Savannah and Richmond, where the presence of our iron clads, prevented the enemy's approaches by rivers, and it is equally applicable at Mobile .... (Mallory 1865)

Although Mallory overstated the actual circumstances, he was partially correct. The ironclads caused reluctance by all Union officers to attack ironclad defended harbors. "Ram fever" was prevalent throughout all Union blockading squadrons. This fear caused Union officers to keep their squadrons on a constant state of alert and even delayed Admiral Farragut's attack at Mobile for about a year, waiting for monitors because of the presence of the *Tennessee*. Another fear Union officers had added to those of the ironclad, was of the Confederate's "infernal machines."

The American Civil War was the first conflict in which mine warfare played a significant role in coastal defense. The use of mines or torpedoes, as they were called, became a vital part of the South's naval strategy for harbor and river defense. By creating the Bureau for the Defense of Coastal Waters and Rivers headed by Matthew Maury and later the congressional mandated Torpedo Bureau and Submarine Battery Service, the South became the first nation to formally recognizing mines as a legitimate means of warfare. The Confederates revealed to the world that the use of a mine by a nation with a weak navy could be highly beneficial with three benefits. Mines are inexpensive, they will cause the enemy to delay or change their plans, and they have a significant psychological impact on the attacking naval force.

For the same reasons the Confederates used mines in the Civil War, they have become the weapons of choice for weaker naval powers today. Mines have been used against the United States by nations with weak naval power in several conflicts including the Korean War, Viet Nam, and Iraq. During Desert Shield and Desert Storm, after their invasion into Kuwait, Iraq used mines to protect itself from a coalition attack from the Gulf. The Iraqis spent the six months after the invasion fortifying its new territory facing the gulf with thousands of sea, and land-based mines. As the U.S. led coalition found out, it would have taken months of intensive mine sweeping operations to open sea-lanes sufficient to landing a force in Kuwait. The coalition forces made the same type of decisions in Desert Storm that Farragut and the Union Navy did at Mobile in 1864. Unlike Farragut, the U.S. led coalition decided to go around the obstructions.

Admiral Farragut's now famous "damn the torpedoes, full speed ahead" is what most remember as a "battle cry" for the navy. If the other mines, only four or five of the eighty worked due to saltwater intrusion from lack of maintenance, in the channel had worked as well as the one that sank the *Tecumseh,* it would have been a terrible tragedy (Addington 1994, 77). Although the Union was successful in landing its amphibious force at Mobile, it showed how a nation with a smaller navy could defend, disrupt, and delay another nation's larger fleet. The fact is after entering the bay, it took over three months, without an opposing navy, to take the city of Mobile, with a cost of eight vessels sunk and over two hundred men killed by Confederate mines. The battle of Mobile Bay represents a Union victory; however, there were other encounters by the U.S. Navy, namely in Richmond and Charleston that were not successful due, in part, to mines.

Dabney H. Maury, Confederate General in Mobile and relative to Matthew Maury, summed up his views of the South's mine warfare program in a postwar article found in the *Southern Historical Society Papers*:

> Had we understood their [torpedoes'] power in the beginning of the war as we came to do before its end, we could have effectually defended every harbor, channel or river throughout the Confederate States against all sorts of naval attacks. It is noteworthy that the Confederate ironclad *Virginia,* by her fearful destruction of the Federal warships in Hampton Roads early in the war, caused all the maritime powers of the world to remodel their navies and build ironclads at enormous expense, only to learn by the Confederate lessons of Mobile that ironclads cannot avail against torpedoes; for, as the Federal naval captain who had been engaged in clearing Mobile bay of the torpedoes and of the wrecks they had made, after the close of the war remarked to the writer: "It makes no difference whether a ship is of wood, or is tin-clad, or is iron-clad, if she gets over a torpedo it blows the same size hole in the bottom of all alike. (Maury 1877, 11)

The submarine was born out of looking for an effective way to deliver an explosive charge, or mine, to the precise location on an enemy vessel that would inflict the greatest damage. To that end, the Confederates produced two such weapons, both having success. The torpedo boat *David* and submarine *H. L. Hunley* both operated out of Charleston roughly at the same time in a defense in-depth role with already laid mines and ironclads as the total defensive strategy.

Torpedo boat production, like the ironclads, was greatly hampered by the industrial shortcoming of the South. After the *David's* success in 1863, the call for more boats of this class went out across the South. Nevertheless, due to the lack of quality steam engines and iron plating, only a dozen or so were completed and most of them, too late in the war to have an impact. Although the torpedo boat's presence came in limited numbers later in the conflict, their significance cannot be overstated.

The *Hunley,* although hand powered and crude by today's standards, had the same effect on Union naval officers as did the *David's,* a killing machine somewhere in the darkness like wolves ready to pounce on their prey. The successful attack on the *Housatonic* had wide-reaching effects on the Union's blockading squadron in Charleston. It not only caused panic as a powerful psychological tool, but also caused drastic changes to blockading operations. Union vessels that must anchor were fitted with antitorpedo devices (a forerunner of the World War I torpedo nets) and the other vessels were ordered to move constantly, placing a tremendous burden on engines and fuel consumption (Luraghi 1996, 259). In a prophetic letter Matthew Maury, wrote to James McClintock, designer of the *Hunley*, described how he envisioned the future of the submarine:

> The boat and machinery was so very simple, that many persons at first inspection believed that they could work ... without practice ... and although I endeavoured to prevent inexperienced persons from going under water .... I was not always successful.... Since the war, I have thought over the subject considerable, and am satisfied that the Power can easily be obtained ... to make the submarine Boat the most formidable enemy of Marine warfare ever known. (McClintock n.d.)

Another way of looking at Mallory's accomplishments in his use of technology is to observe all the firsts his navy accumulated:

1. The first to engage and sink a wooden ship with an ironclad
2. The first battle between ironclads (North and South)
3. The first to use electricity at sea (electrical mines)
4. The first to build and use torpedo boats
5. The first to use mines to sink a ship
6. The first to successfully engage and sink a ship with a submarine

In the end, the overwhelming advantage of the industrial complex of the North was too great for the Confederate Navy to overcome. However, the lessons learned from this part of the U.S.'s history are as relevant today as they were at the end of the war. Mines are many of today's nations weapons of choice. As they did to Admiral Farragut in Mobile, mines will hamper all attempts of amphibious operations unless prepared to perform an in-stride mine-clearing operation. Since 1950, an enemy or foreign nation's weapon has damaged eighteen U.S. naval ships. Of those ships, mines strikes damaged fourteen of them. In Desert Storm, we had the luxury to negate the mine threat by going around them. That might not be an option in future battles.

On the strategic level, the U.S. Navy faces a similar situation as the Confederate Navy did in 1861. The Navy must balance the need for new technology because of the current "do more with less" age with being able to preserve the invaluable skills that have learned, often the hard way, throughout the past two centuries. The U.S. Navy must not look on new technology to provide us with the "ultimate weapon," as Mallory at first hoped of the ironclad. However, the nation must use it to build a complete Navy, to not only counter the threats of today but those of tomorrow.

ILLUSTRATIONS

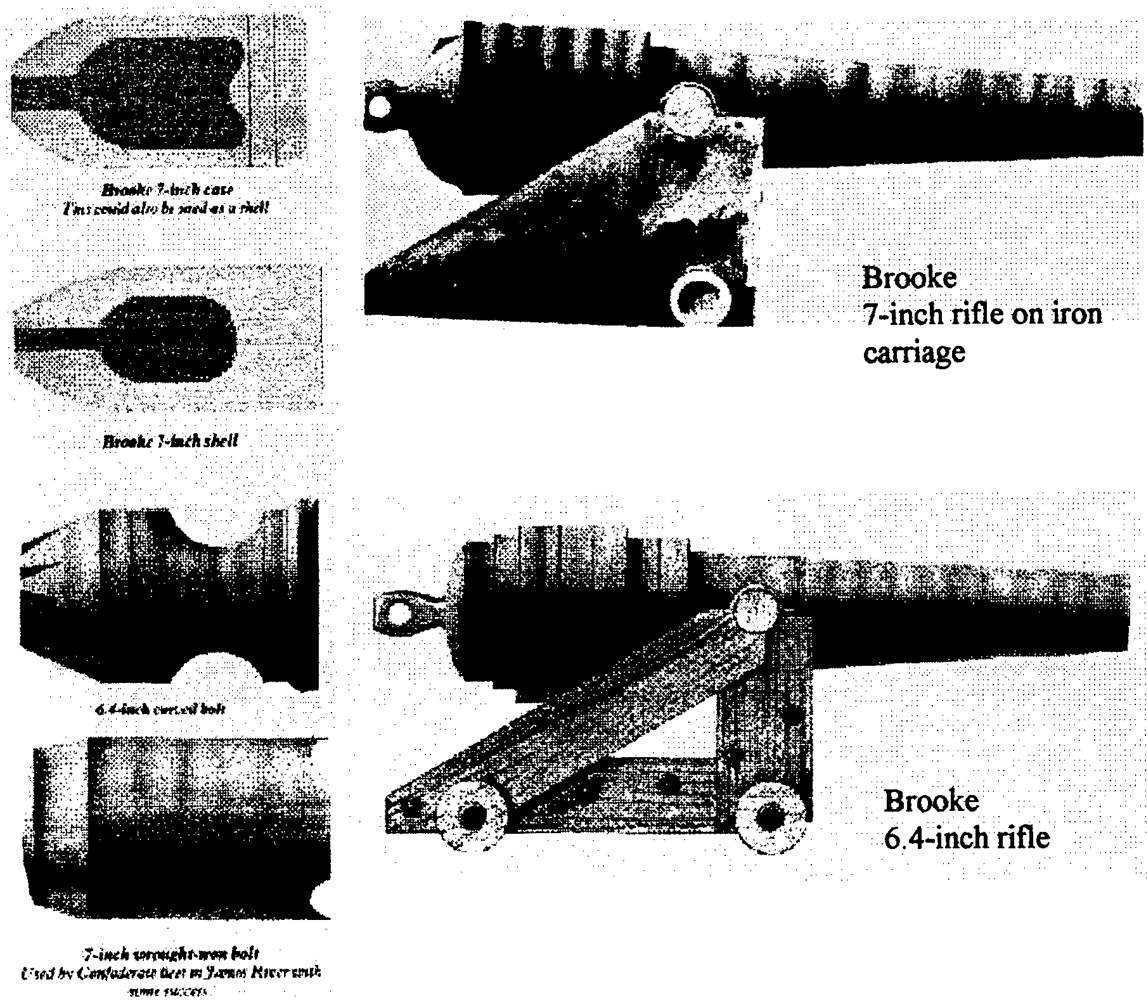

Figure 1. Pictures of various shells and bolts used in Brooke rifled guns. Also Pictured are Brooke 6.4" and 7-inche rifle guns. Reprinted with permission from Drury and Gibbons, 1993, *The Civil War Military Machine: Weapons and Tactics of the Union and Confederate Armed Forces,* 126-127, 136.

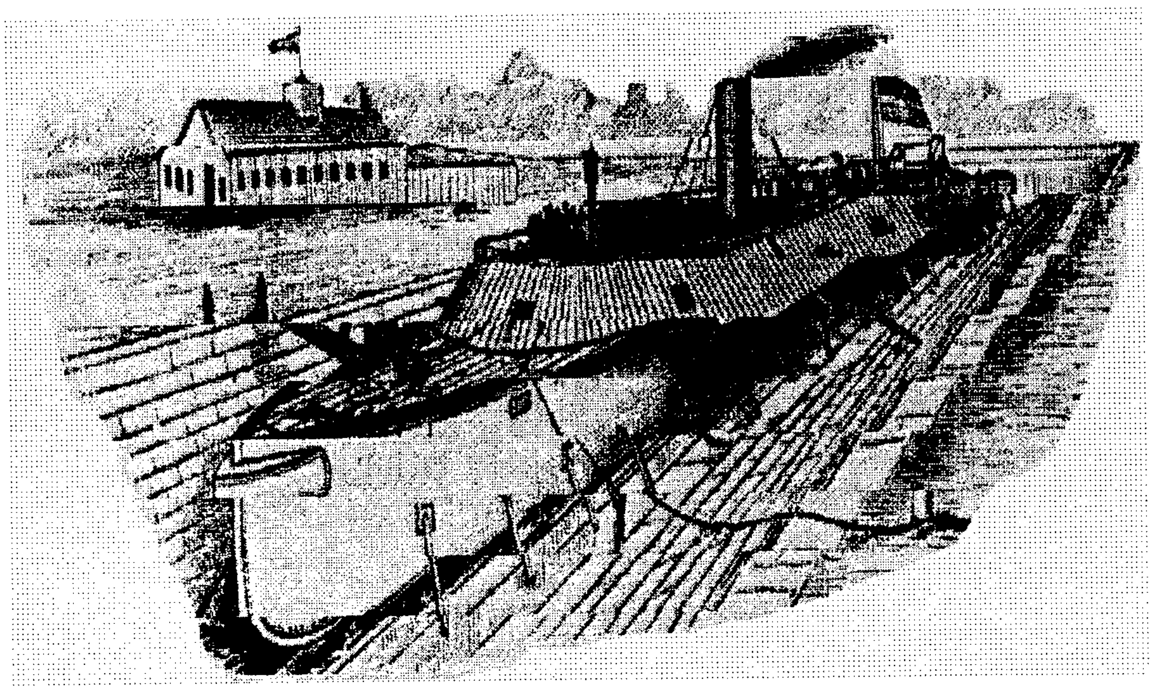

Figure 2. The *CSS Virginia* while in drydock, after being armored. Picture reprinted from Thomas J. Scharf, 1887, *History of the Confederate States Navy,* 154.

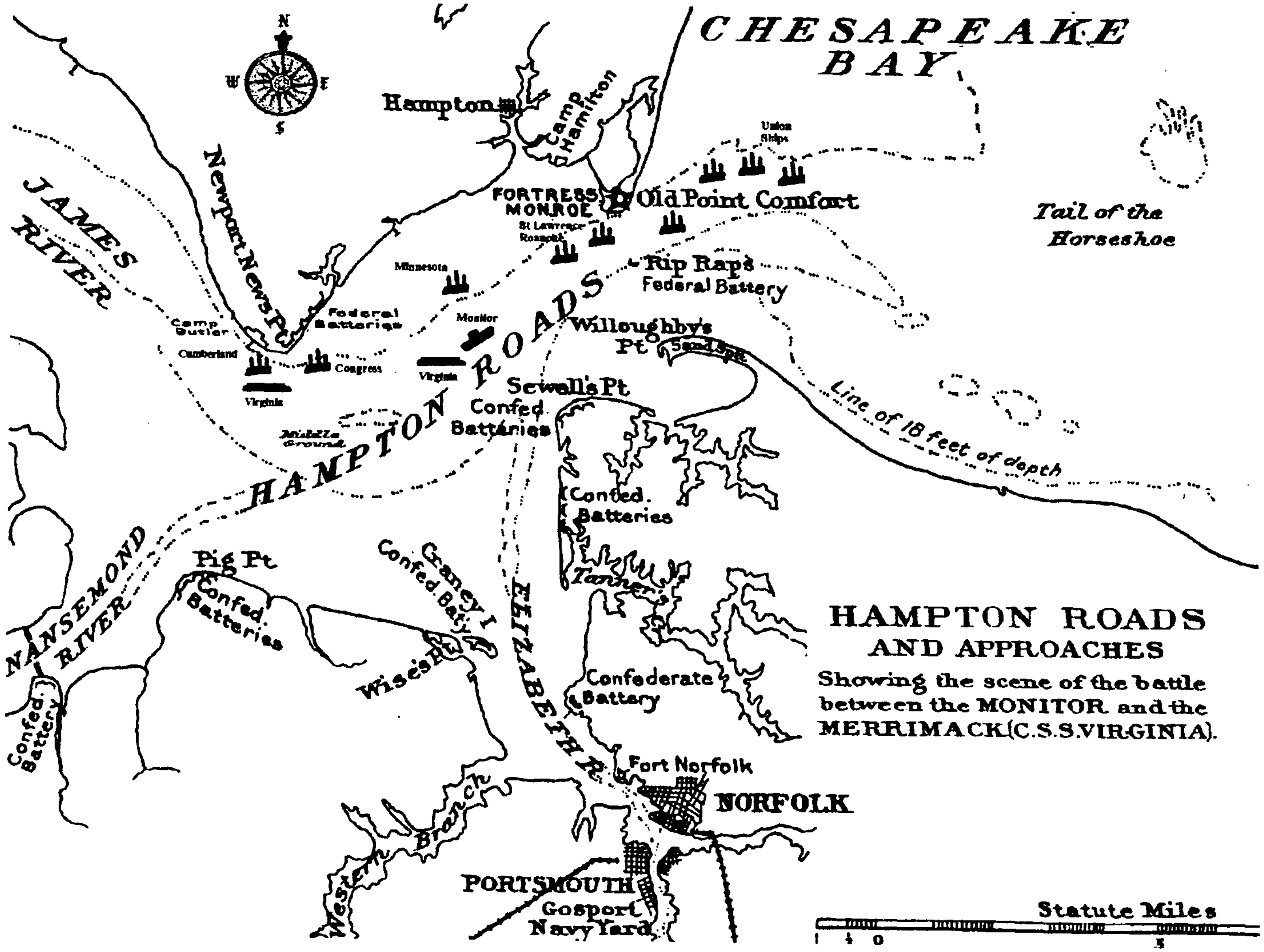

Figure 3. Map of the CSS *Virginia* Battles of 8-9 March 1862. Map adapted from ORN

Figure 4. Map of the South showing the Confederate Naval Yards, Stations, and Facilities. Reprinted with permission from William N. Still Jr., ed, 1997, *The Confederate Navy*, 69.

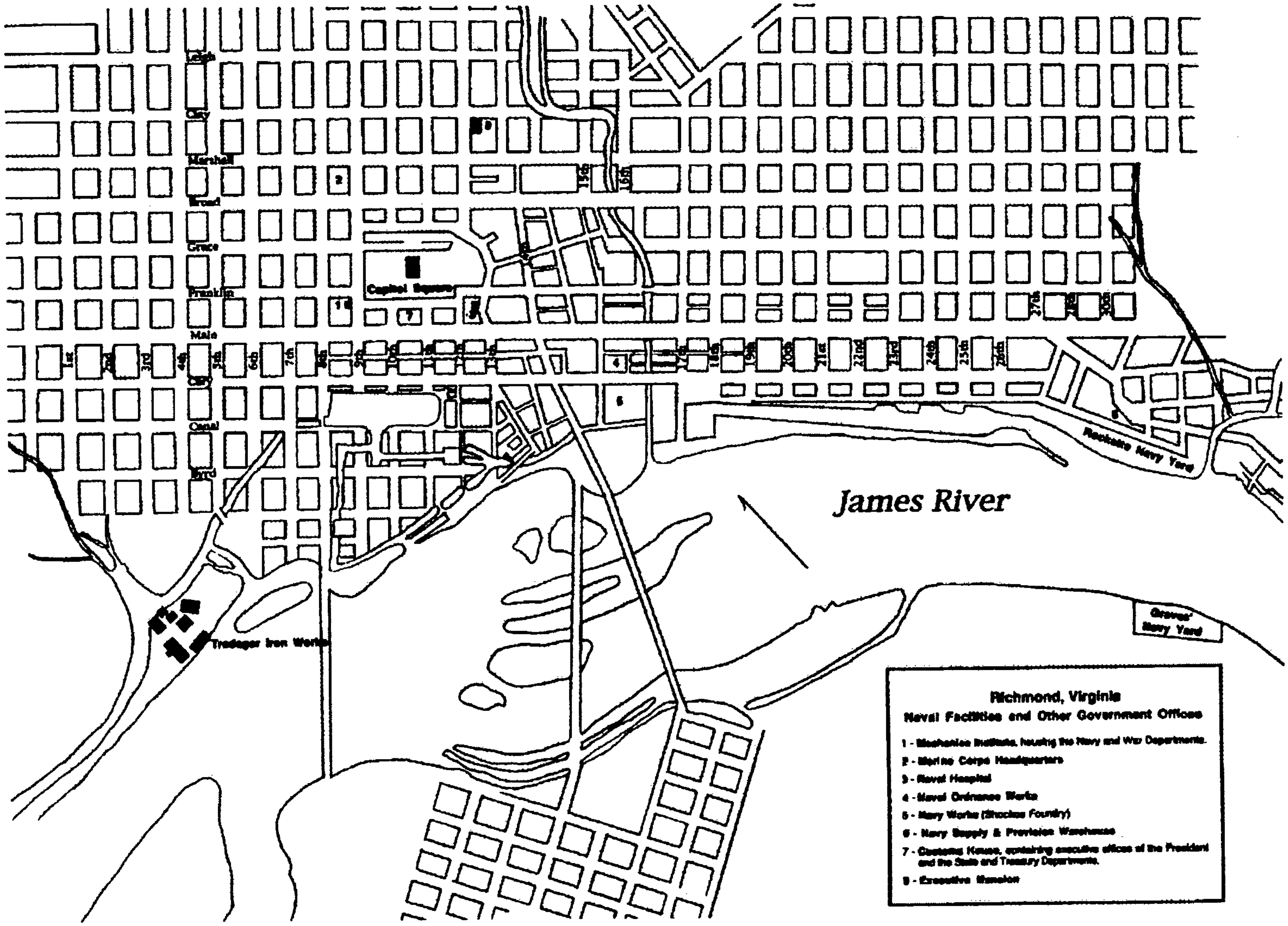

Figure 5. Naval Facilities in Richmond, Virginia. Reprinted with permission from William N. Still Jr., ed., 1997, *The Confederate Navy*, 84.

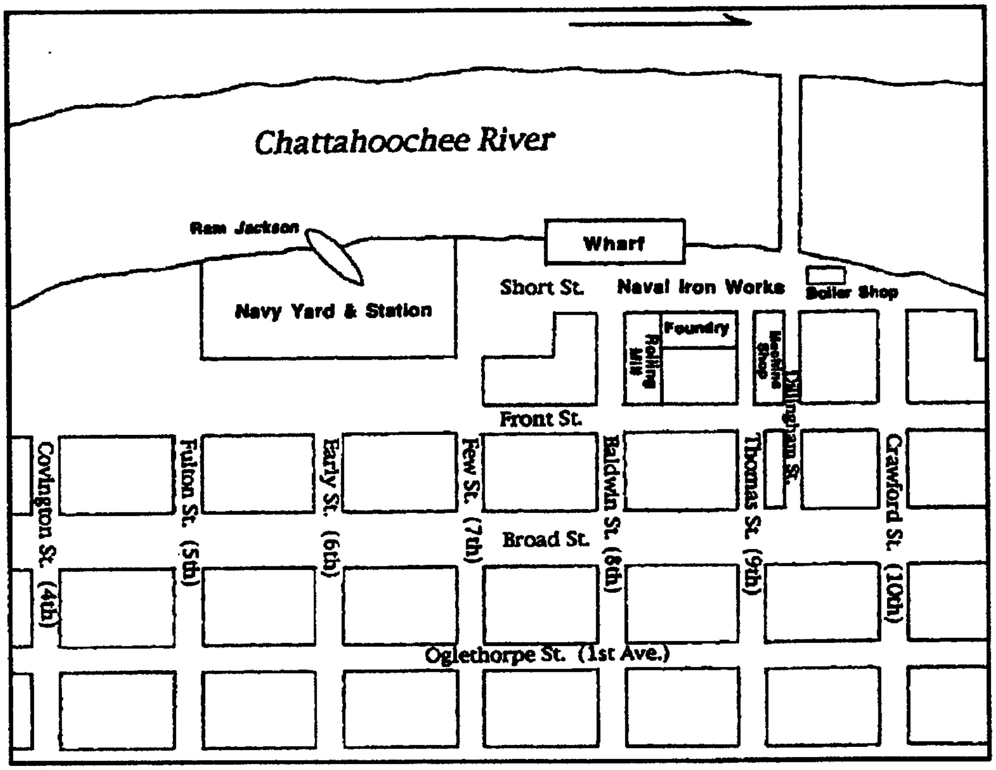

Figure 6. Naval Iron Works and Navy Yard, Columbus, Georgia. Reprinted with permission from William N. Still Jr., ed., 1997, T*he Confederate Navy*, 81.

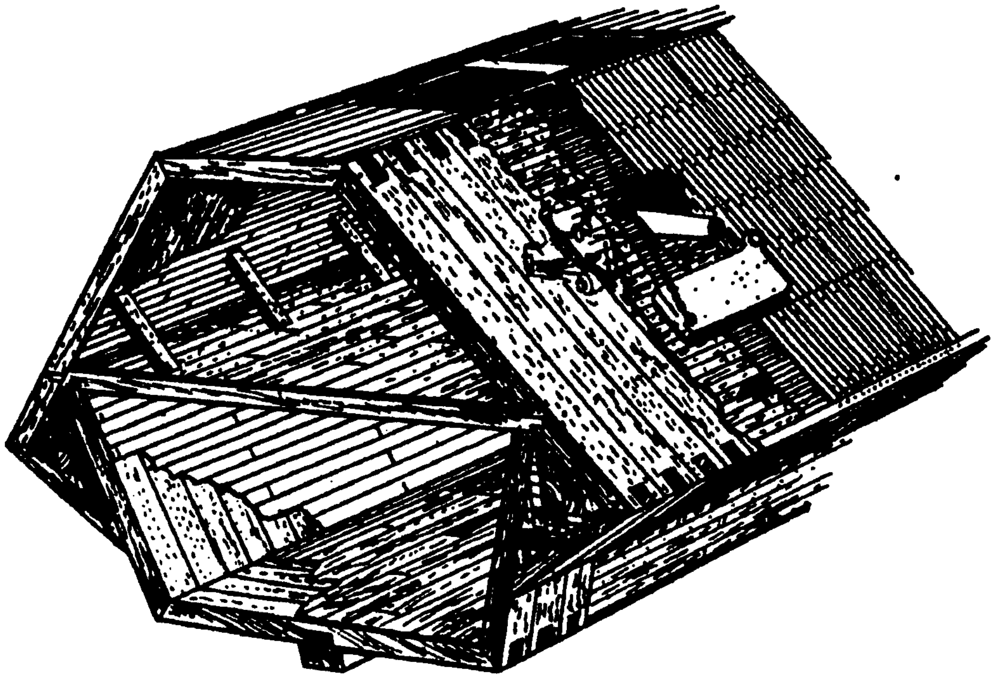

Figure 7. Picture of the diamond hull of a Albemarle Class ironclad. Reprinted with permission from Robert MacBride, 1962, *Civil War Ironclads,* 79.

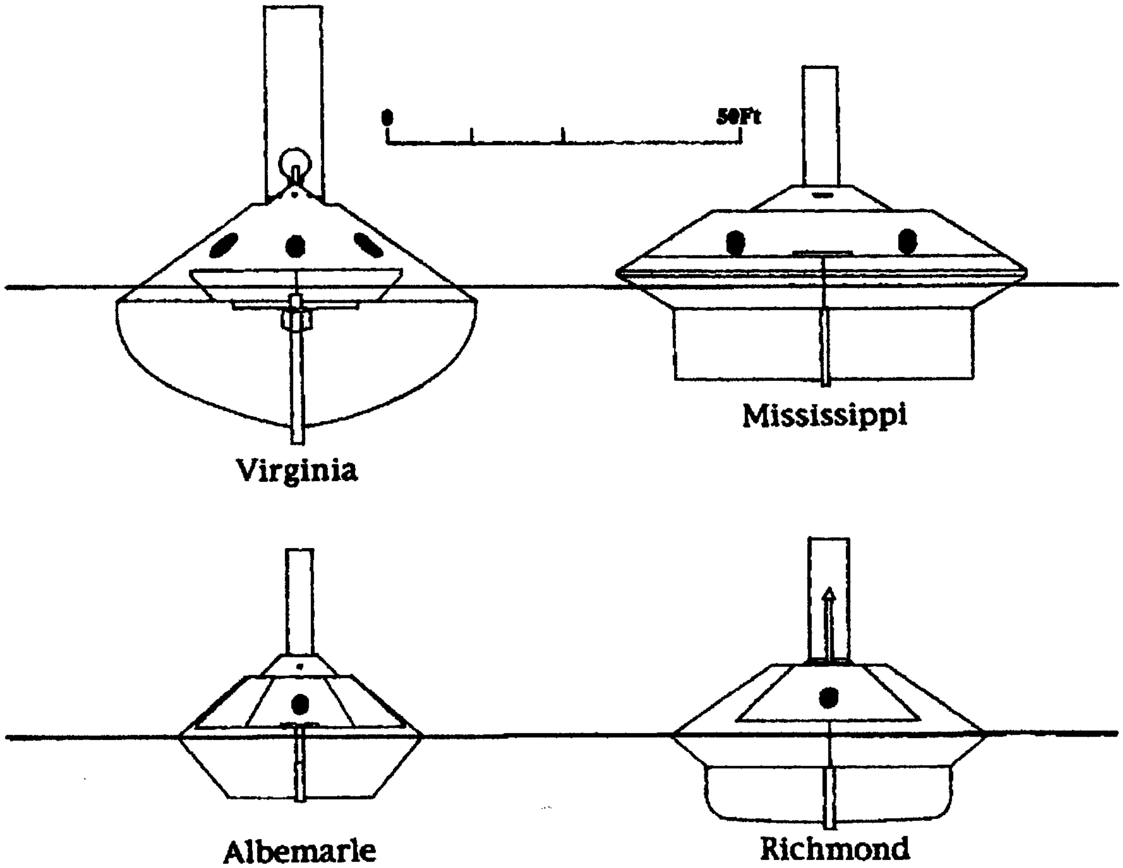

Figure 8. Picture of Confederate ironclad hull types. Reprinted with permission fromWilliam N. Still Jr., ed., 1997, *The Confederate Navy*, 53.

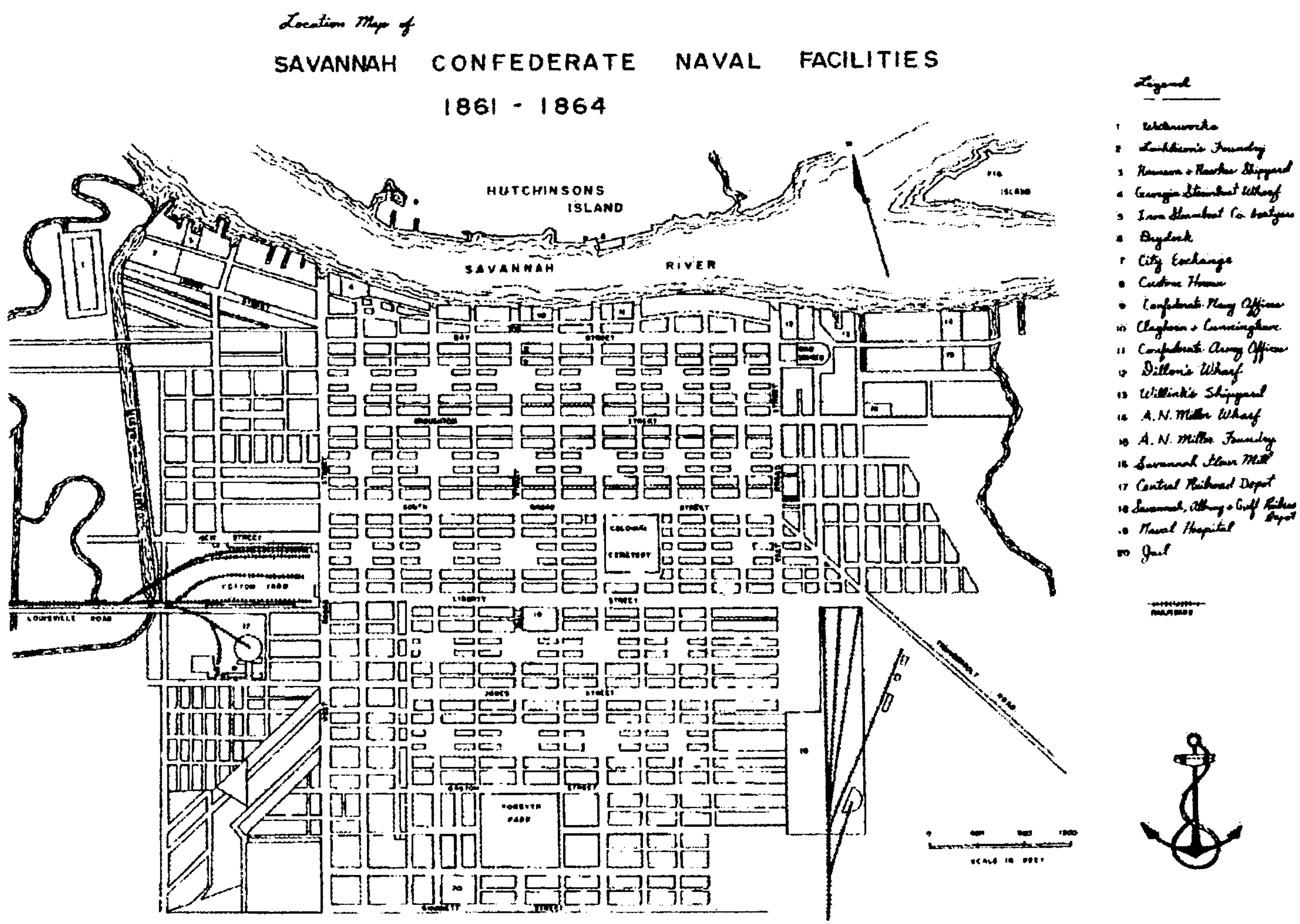

Figure 9. Naval Facilities, Savannah, Georgia. Reprinted with permission from William N. Still Jr., ed., 1997, *The Confederate Navy*, 94.

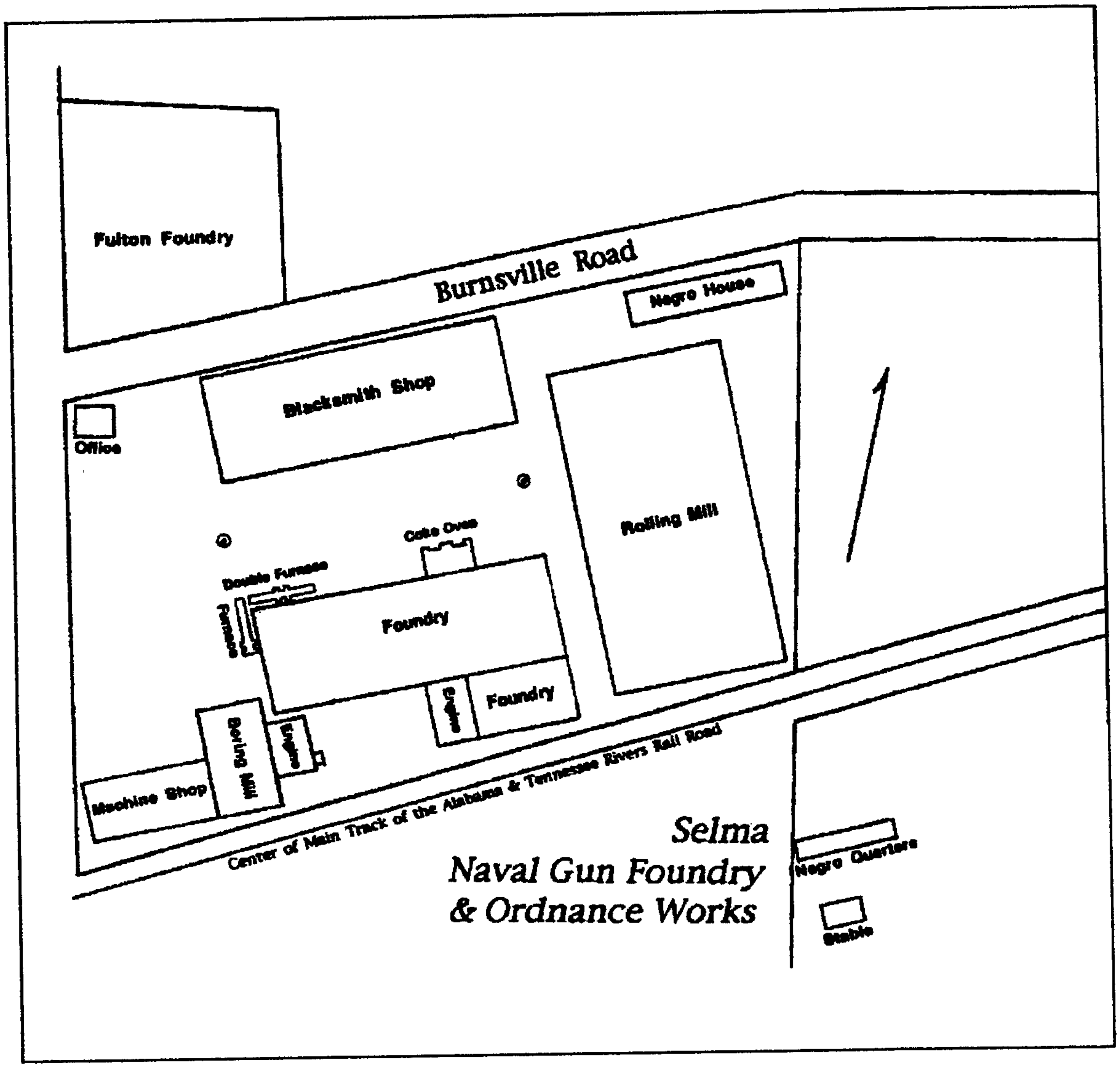

Figure 10. Naval Gun Foundry and Ordnance Works, Selma, Alabama. Reprinted with permission from William N. Still Jr., ed., 1997, *The Confederate Navy*, 86.

Confederate Torpedo Organization
(After October, 1862 Congressional Legislation)

Secretary of War

- **Secretary of Navy**
  - **The Submarine Battery Service**
    (Electric Torpedoes)
    LT Hunter Davidson
- **Secret Service Corps**
  CPT Thomas Courtenay
- **Secretary of Army**
  - **The Torpedo Bureau**
    (Mechanical Torpedoes)
    GEN Gabriel Rains

Figure 11

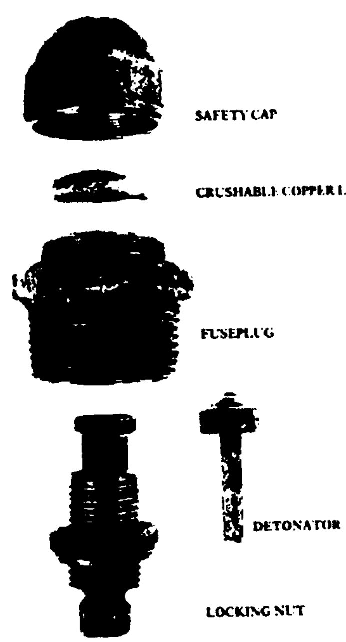

Figure 12. Actual Rain's fuse reprinted with permission from David Nevin, 1986, *Time-Life's The Civil War: Sherman's March*.

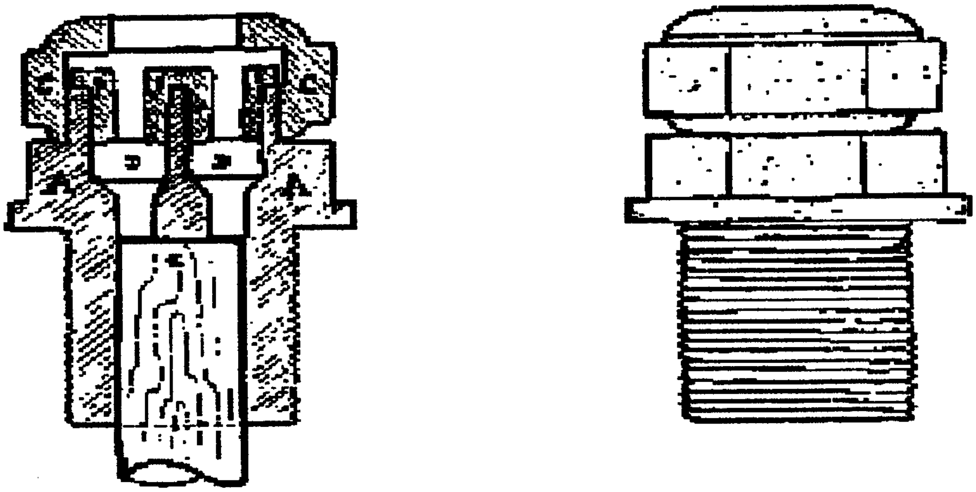

Figure 13. Example of typical fuse used in the electrical torpedoes. Reprinted from John S. Barnes, 1869, *Submarine Warfare, Offensive and Defensive*, .

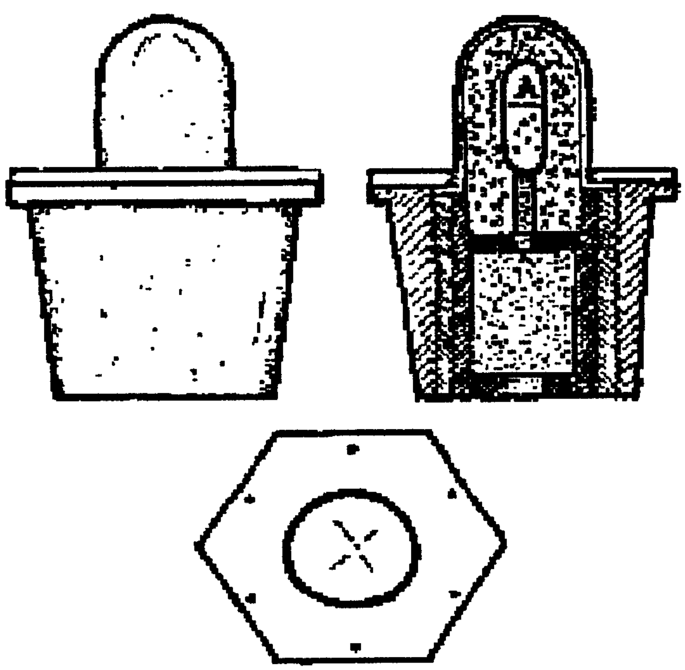

Figure 14. Example of a chemical fuse used in electrical torpedoes. Reprinted from John S. Barnes, 1869, *Submarine Warfare, Offensive and Defensive*.

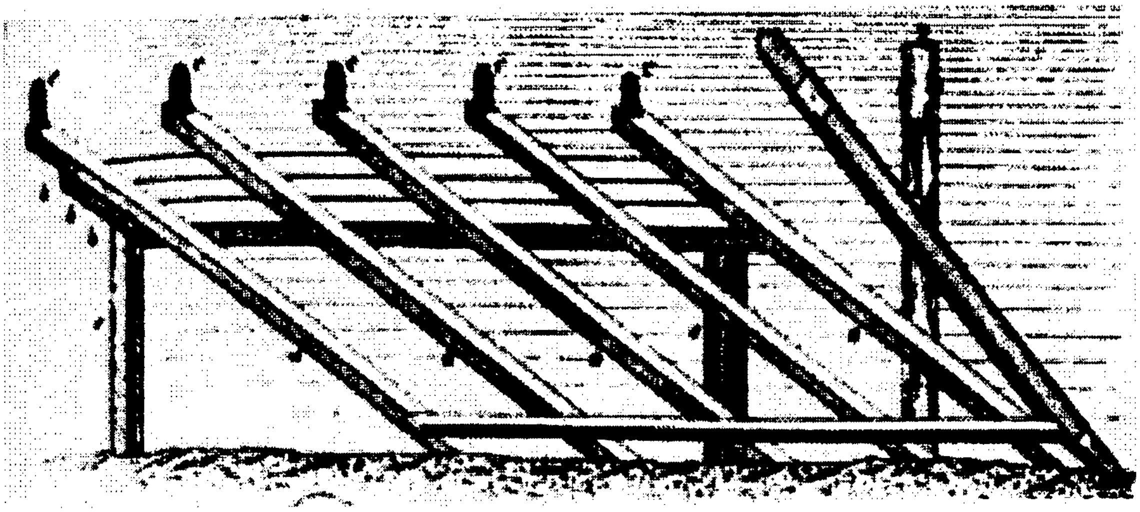

Figure 15. Rain's Frame Torpedo. Reprinted from John S. Barnes, 1869, *Submarine Warfare, Offensive and Defensive*.

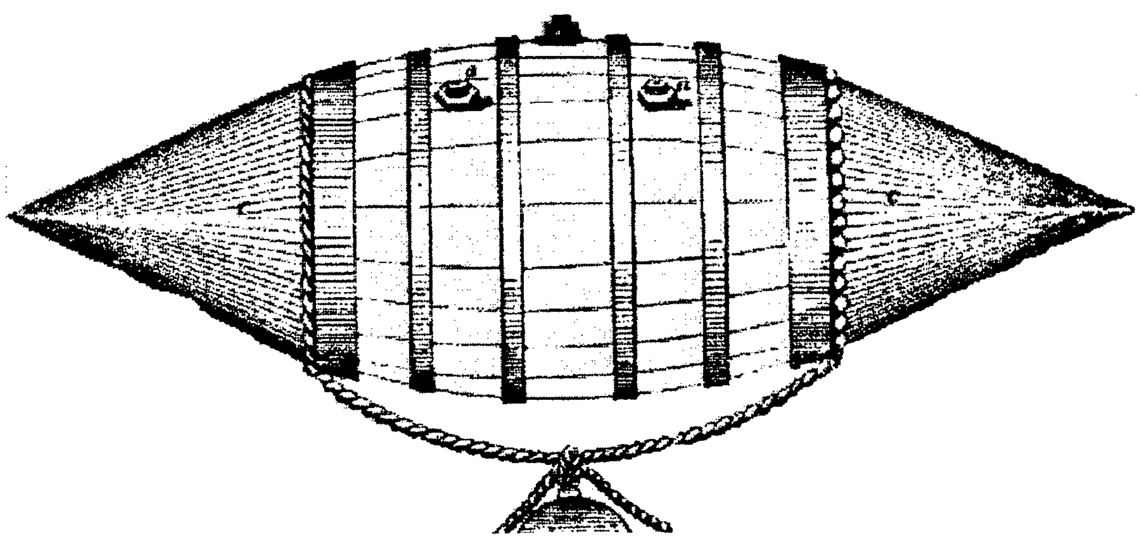

Figure 16. Keg Torpedo. Drawing reprinted from Thomas J. Scharf, 1887, *History of the Confederate States Navy from its Organization to the Surrender of its Last Vessel*, 757.

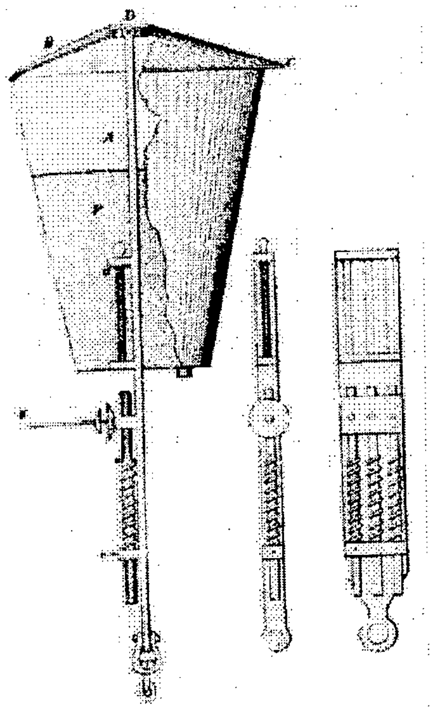

Figure 17. Fretwell-Singer torpedo. Drawing reprinted from John S. Barnes, 1869, *Submarine Warfare, Offensive and Defensive*.

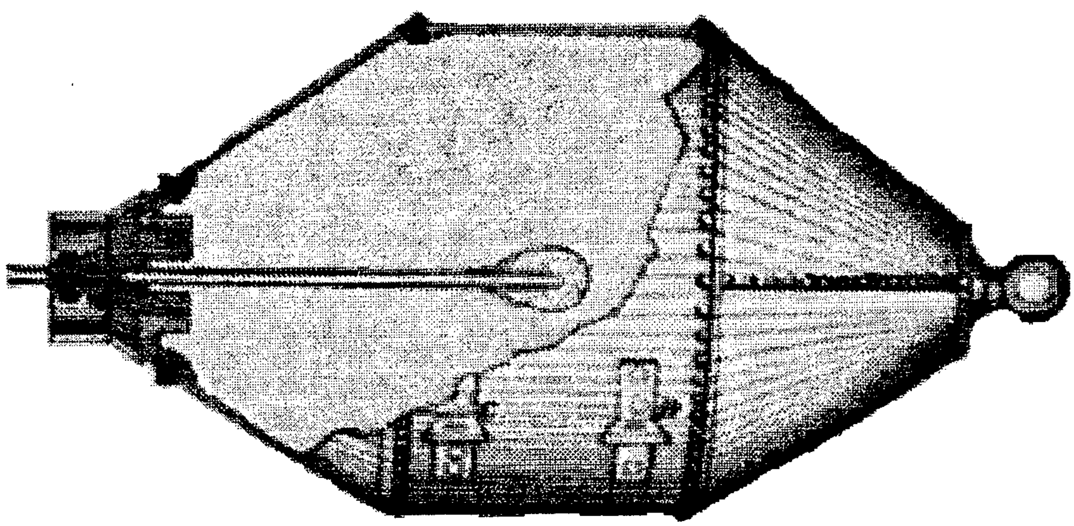

Figure 18. Electrical torpedo. Drawing reprinted from Thomas J. Scharf, 1887, *History of the Confederate States Navy from its Organization to the Surrender of its Last Vessel*, 755.

818 OPERATIONS OF THE CRUISERS—CONFEDERATE.

List of privateers known to have been commissioned by

[No reports of the operations of the Confederate privateers having been found, this list is com-
It is believed, however, that other privateers were fitted out and other prizes captured by the below
been omitted.]

Name.	Ports from which fitted out.	Class.	Master.
A. C. Gunnison	Mobile, Ala	Steam tug	Peter G. Cook
Beauregard	Charleston, S. C	Schooner	Gilbert Hay
Calhoun	New Orleans, La	Steamer	John Wilson
Prizes:			
John Adams		Schooner	C. B. Averill
Mermaid		Schooner	—— Soper
Panama		Brig	—— Powell
Dixie	Charleston, S. C	Schooner	Thos. J. Moore
Prizes:			
Glenn		Bark	
Rowena		Bark	
Mary Alice		Schooner	
Gibraltar	Mobile, Ala	Schooner	W. G. Ford
Gordon	Charleston, S. C	Steamer	Thos. J. Lockwood
Prizes:			
Protector		Schooner	T. J. Linnekin
Wm. McGilvery		Brig	—— Harriman
Gov. A. Mouton	New Orleans, La	Steamboat	Sam'l E. Parker
Isabella	New Orleans, La	Steam propeller	Jas. I. Bard
Jefferson Davis	Charleston, S. C	Brig	Louis M. Coxetter
Prizes:			
John Welsh		Brig	—— Fifield
Enchantress		Schooner	—— Devereaux
S. J. Waring		Schooner	—— Smith
Alvarado		Bark	
Santa Clara		Brig	
John Carver		Ship	—— Edge
Mary E. Thompson		Brig	—— Havener
Mary Goodell		Schooner	—— McGilvery
J. O. Nixon	New Orleans, La	Schooner	John Wilson
Lorton	Baltimore, Md	Schooner	W. T. Kendall
Manassas	New Orleans, La	Steam propeller	Jno. A. Stevenson
Mariner	Wilmington, N. C	Steam propeller	B. W. Berry
Prize:			
Nathaniel Chase		Schooner	Daniel Deane
Matilda	New Orleans, La	Bark	F. Belcher
Music	New Orleans, La	Steamer	Thos. McLellan
Petrel	Charleston, S. C.	Schooner	Wm. Perry
Pioneer	New Orleans, La	Submarine propeller	John K. Scott
Rattlesnake	Charleston, S. C	Steamship	T. Harrison Baker
Retribution	Galveston, Tex	Schooner	Thos. B. Power
Prizes:			
Emily Fisher		Brig	—— Staples
Hanover		Schooner	Washington Case
J. P. Ellicott		Brig	—— Devereux
Sallie	Charleston, S. C	Schooner	Henry S. Lebby
Prizes:			
B. K. Eaton		Brig	
Betsey Ames		Brig	Richard C. Bartlett
Elsinore		Brig	
Granada		Brig	A. C. Pettengill
Savannah	Charleston, S. C	Schooner	T. Harrison Baker
Prize:			
Joseph		Brig	—— Myers
Sealine	Baltimore, Md	Brig	W. T. Kendall
V. H. Ivy	New Orleans, La	Steamer	N. B. Baker
Wm. H. Webb	New Orleans, La	Steamer	Joseph Leach
York	Norfolk, Va	Schooner	John Godfrey
Prizes:			
B. T. Martin		Brig	
Geo. G. Baker		Schooner	

Figure 19. Register of private ships issued letter of marques. Register found in *Official Records of the Union and Confederate Navies in the War of the Rebellion*, Series I, vol. 1:818.

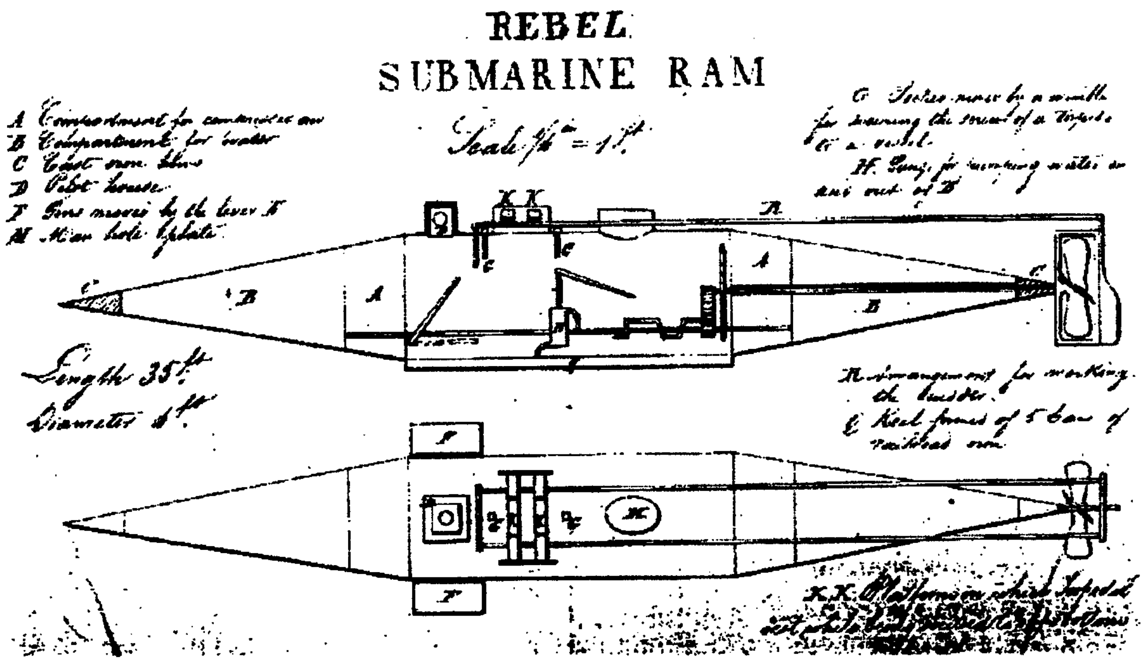

Figure 20. The "Rebel Submarine Ram," *Pioneer,* documented by William Shock, Engineer off the USS *Pensacola* after the fall of New Orleans in 1862. Reprinted with permission from Mark K. Ragan, 1999, *Union and Confederate Submarine Warfare in the Civil War,*

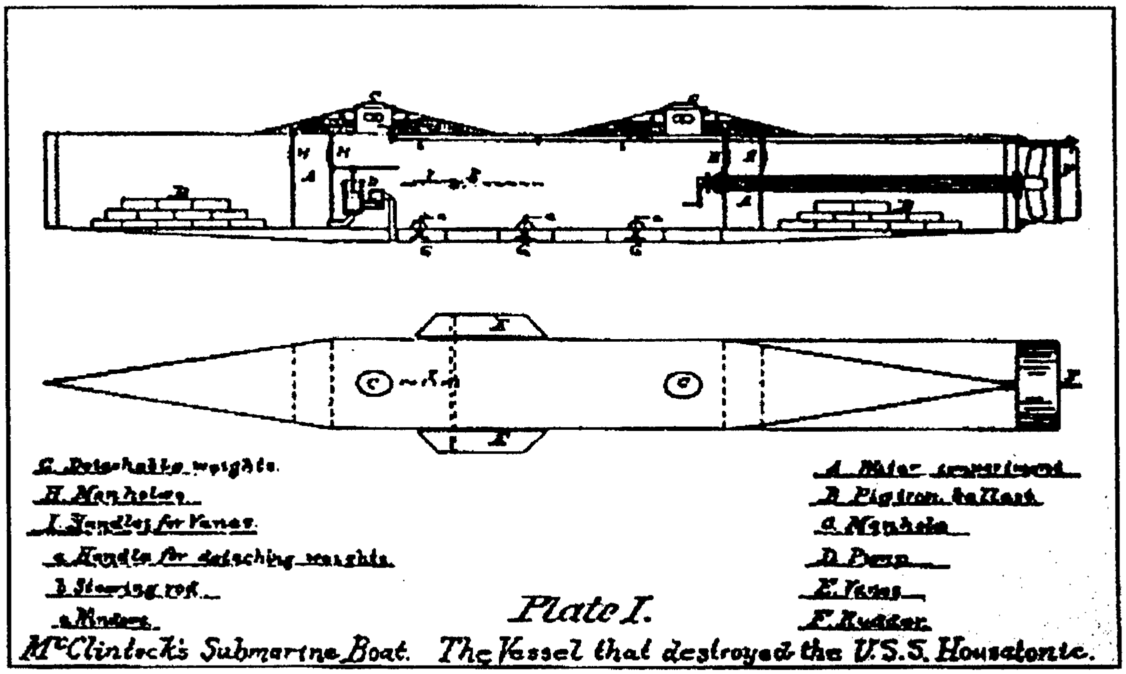

Figure 21. Diagram of American Diver drawn by Rear Admiral Baird in McClintock's presence. Mislabeled as "The Vessel that destroyed the USS *Housatonic*." Reprinted from G. W. Baird, 1902, *Submarine*

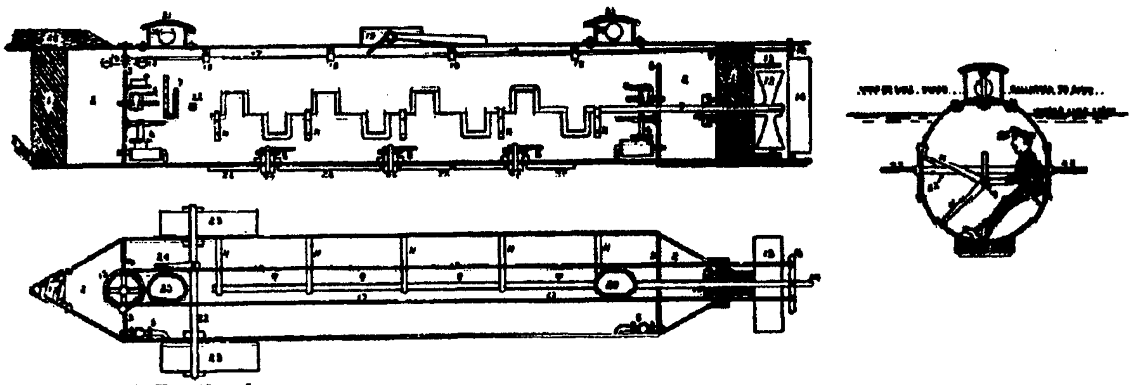

Figure 22. Diagram of the *H. L. Hunley*, drawn by William A. Alexander, showing the boat's longitudinal elevation plan view, and a transverse section. Alexander's numbers represent the following features: (1) the bow and stern castings; (2) water-ballast tanks; (3) tank bulkheads; (4) compass; (5) sea cocks; (6) pumps; (7) mercury gauge; (8) keel-ballast stuffing boxes; (9) propeller shaft and cranks; (10) stern bearing and gland; (11) shaft braces; (12) propeller; (13) wrought ring around propeller; (14) rudder; (15) steering control; (16) steering lever; (17) steering rods; (18) rod braces; (19) air box; (20) hatchways; (21) hatch covers; (22) shaft of side fins; (23) side fins; (24) shaft lever; (25) one of the crew turning propeller shaft; (26) cast-iron keel ballast; (27) bolts; (28) butt end of torpedo boom. Sketch reprinted from *Official Records of the Union and Confederate Navies in the War of the Rebellion*, Series I, Vol. 15:338.

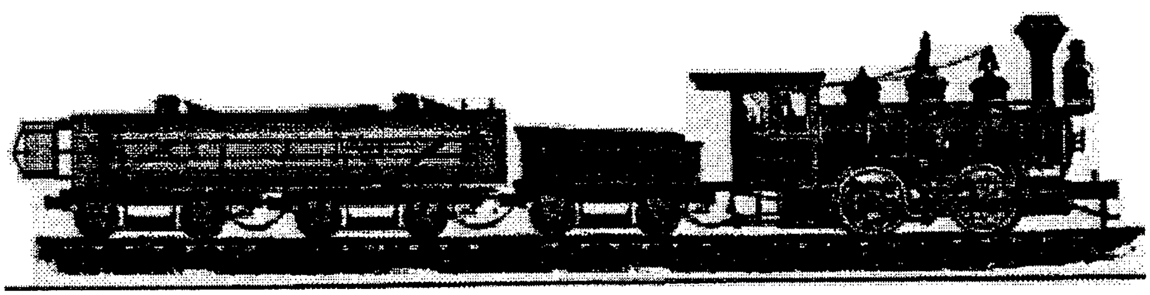

Figure 23. The *Hunley* transported to Charleston. Reprinted with permission from Mark K. Ragan, *The Hunley: Submarines, Sacrifices, & Success in the Civil War*, 34.

TABLES

TABLE 1

CONFEDERATE IRONCLADS

Virginia waters:

Virginia (Ex-Merrimack)					
Length:	262'9"	Beam:	51'4"	Draft:	22'
Tonnage:	3,200	Speed:	5-6 kts	Crew:	320
Armor:	4" casemate, 4" pilothouse				
Armament:	Six 9" Dahlgren smoothbores, two 7" and two 6.4" Brooke rifles				
Authorized:	11 Jul 61	Launch:	13 Feb 62	Comm:	17 Feb 62
			Converted At:	Norfolk VA	

Richmond					
Length:	172'6"	Beam:	45'	Draft:	12'
Tonnage:	850?	Speed:	6 kts	Crew:	180
Armor:	4" casemate				
Armament:	One 7" and two 6.4" Brooke rifles, 10" smoothbore, spar torpedo				
Authorized:	17 Mar 62	Launch:	6 May 62	Comm:	Jul 62
			Built At:	Norfolk VA (completed at Richmond)	

Fredericksburg					
Length:	188'	Beam:	40'3"	Draft:	9'6"
Tonnage:	700	Speed:	?	Crew:	150
Armor:	4" casemate				
Armament:	One 8" and two 6.4" Brooke rifles, one 11" Dahlgren smoothbore				
Authorized:	1862	Launch:	30 Nov 63	Comm:	Mar 64
			Built At:	Richmond VA	

Virginia II					
Length:	197'	Beam:	47'6"	Draft:	14'
Tonnage:	1,600?	Speed:	10 kts	Crew:	150
Armor:	6" forward, 5" casemate sides				
Armament:	One 8" and two 6.4" Brooke rifles, one 11" Dahlgren smoothbore				
Authorized:	?	Launch:	Jun 64	Comm:	Summer 64
			Built At:	Richmond VA	
***Texas* (never completed)**					
Length:	217'	Beam:	48'6"	Draft:	13'6"
Tonnage:	1,700?	Speed:	?	Crew:	150?

Armor:	6" casemate				
Armament:	Two 8" and two 7" Brooke rifles, two 11" Brooke smoothbores				
Authorized:	?	Launch:	Jan 65	Comm:	never
			Built At:	Richmond VA	

North Carolina waters:

North Carolina					
Length:	172'6"	Beam:	34'	Draft:	12'
Tonnage:	850?	Speed:	5 kts	Crew:	188
Armor:	4" casemate				
Armament:	Two 7" and two 6.4" Brooke rifles				
Authorized:	Spring 62	Launch:	Oct 63	Comm:	Dec 63
			Built At:	Wilmington NC	

Raleigh					
Length:	172'6"	Beam:	34'	Draft:	12'
Tonnage:	850?	Speed:	6 kts	Crew:	180
Armor:	4" casemate				
Armament:	Four 6.4" Brooke rifles				
Authorized:	Spring 62	Launch:	Fall 63	Comm:	30 Apr 64
			Built At:	Wilmington NC	

Albemarle					
Length:	158'	Beam:	35'3"	Draft:	8'2"
Tonnage:	500?	Speed:	5 kts	Crew:	150
Armor:	4" casemate, 1" fore/aft decks, 2" fore/aft sides				
Armament:	Two 6.4" Brooke rifles				
Authorized:	16 Apr 62	Launch:	6 Oct 63	Comm:	17 Apr 64
			Built At:	Edwards Ferry NC (completed at Halifax NC)	

Neuse					
Length:	158'1"	Beam:	34'	Draft:	8'
Tonnage:	500	Speed:	4 kts	Crew:	150
Armor:	4" forward, 2" side and aft casemate (4" planned)				
Armament:	Two 6.4" Brooke rifles				
Authorized:	Oct 62	Launch:	Aug 63	Comm:	May 64
			Built At:	White Hall (now Seven	

		Springs) NC, completed at Kinston NC

***Wilmington* (never completed)**					
Length:	224'	Beam:	42'6"	Draft:	9'6"
Tonnage:	1,100?	Speed:	?	Crew:	?
Armor:	Two oval or octagonal casemates				
Armament:	Two guns, probably Brooke rifles				
Authorized:	?	Launch:	never	Comm:	never
			Built At:	Wilmington NC	

South Carolina waters:

Palmetto State					
Length:	172'6"	Beam:	34'	Draft:	12'
Tonnage:	850?	Speed:	5 kts	Crew:	125
Armor:	4" casemate				
Armament:	Two 7" Brooke rifles, two 9" Dahlgren smoothbores				
Authorized:	Feb 62	Launch:	Mar 62	Comm:	Fall 62
			Built At:	Charleston SC	

Chicora					
Length:	172'6"	Beam:	34'	Draft:	12'
Tonnage:	850?	Speed:	4-5 kts	Crew:	125
Armor:	4" casemate				
Armament:	Two 9" Dahlgren smoothbores, four 32# rifles				
Authorized:	Spring 62	Launch:	23 Aug 62	Comm:	Nov 62
			Built At:	Charleston SC	

Charleston					
Length:	200'	Beam:	45'	Draft:	14'
Tonnage:	1,050?	Speed:	5-6 kts	Crew:	150
Armor:	4" casemate				
Armament:	Two 9" Dahlgren smoothbores, four 32#rifles or four Brooke rifles				
Authorized:	Fall 62	Launch:	Dec 62	Comm:	Spring 64
			Built At:	Charleston SC	

Columbia					
Length:	216'	Beam:	51'4"	Draft:	13'6"
Tonnage:	1,800?	Speed:	?	Crew:	150
Armor:	6" casemate				
Armament:	One 10" Brooke smoothbore, three 7" and two 6.4" Brooke rifles				
Authorized:	?	Launch:	10 Mar 64	Comm:	12 Jan 65
			Built At:	Charleston SC	

Georgia waters:

Georgia					
Length:	250'	Beam:	60'	Draft:	12'
Tonnage:	1,000?	Speed:	Immobile	Crew:	94 to 122
Armor:	two layers of T-rails, about 4"				
Armament:	Varied; ten gun planned, but usually only two 9" and three 32# smoothbores				
Authorized:	Early 62	Launch:	20 May 62	Comm:	Jul 62
			Built At:	Savannah GA	

Atlanta (Ex-Fingal)					
Length:	204'	Beam:	41'	Draft:	15'9"
Tonnage:	1,006	Speed:	7 kts	Crew:	165
Armor:	4" casemate, ½" deck				
Armament:	Two 7" and two 6.4" Brooke rifles, spar torpedo				
Authorized:	1862	Launch:	Summer 62	Comm:	22 Nov 62
			Converted At:	Savannah GA	

Savannah					
Length:	172'6"	Beam:	34'	Draft:	12'6"
Tonnage:	850?	Speed:	6 kts	Crew:	181
Armor:	4" casemate				
Armament:	Two 7" and two 6.4" Brooke rifles				
Authorized:	Spring 62	Launch:	4 Feb 63	Comm:	30 Jun 63
			Built At:	Savannah GA	

***Milledgeville* (never completed)**					
Length:	175'	Beam:	35'3"	Draft:	9'
Tonnage:	650?	Speed:	?	Crew:	?

Armor:	6" casemate				
Armament:	Four guns, probably 7" and 6.4" Brooke rifles				
Authorized:	?	Launch:	Oct 64	Comm:	never
			Built At:	Savannah GA	

Jackson					
Length:	223'6"	Beam:	59'	Draft:	8'
Tonnage:	1,250?	Speed:	?	Crew:	?
Armor:	4" casemate				
Armament:	Four 7" and two 6.4" Brooke rifles				
Authorized:	?	Launch:	22 Dec 64	Comm:	Apr 65
			Built At:	Columbus GA	

Alabama waters:

Baltic (converted of a sidewheel tug)					
Length:	186'	Beam:	38'	Draft:	6'5"
Tonnage:	624	Speed:	5 kts	Crew:	86
Armor:	2½" forward casemate, cottonclad aft				
Armament:	Two 42# and two 32# smoothbores, two light howitzers				
Authorized:	Dec 61	Launch:	Spring 62	Comm:	27 May 62
			Converted At:	Mobile AL	

Huntsville					
Length:	150'-170'	Beam:	34'	Draft:	7'
Tonnage:	500?	Speed:	3.5 kts	Crew:	120
Armor:	4" casemate				
Armament:	One 6.4" Brooke rifle, three 32# smoothbores				
Authorized:	1 May 62	Launch:	7 Feb 63	Comm:	1 Aug 63
			Built At:	Selma AL (completed at Mobile AL)	

Tuscaloosa					
Length:	150'-170'	Beam:	34'	Draft:	7'
Tonnage:	500?	Speed:	2.5 kts	Crew:	120
Armor:	4" casemate				
Armament:	One 6.4" Brooke rifle, three 32# smoothbores				
Authorized:	1 May 62	Launch:	7 Feb 63	Comm:	Fall 63
			Built At:	Selma AL (completed at Mobile AL)	

Tennessee					
Length:	209'	Beam:	48'	Draft:	14'
Tonnage:	1,273	Speed:	6-7 kts	Crew:	133
Armor:	6" forward, 5" casemate sides, 2" deck				
Armament:	Two 7" and four 6.4" Brooke rifles				
Authorized:	Sep 62	Launch:	Oct 62	Comm:	16 Feb 64
			Built At:	Selma AL (completed at Mobile AL)	

Nashville					
Length:	271'	Beam:	62'6"	Draft:	10'9"
Tonnage:	1,100?	Speed:	?	Crew:	?
Armor:	6" casemate forward of wheels, 2" aft, wheelboxes unarmored				
Armament:	Three 7" Brooke rifles				
Authorized:	Sep 62	Launch:	1863	Comm:	15 Sep 64
			Built At:	Montgomery AL (completed at Mobile AL)	

Louisiana waters:

***Manassas* (ex-*Enoch Train*)**					
Length:	143'	Beam:	33'	Draft:	11'
Tonnage:	387 (burden)	Speed:	4 kts	Crew:	36
Armor:	1½" casemate				
Armament:	One 64# or 32# smoothbore				
Authorized:	n/a	Completed:	Sep 61	Comm:	11 Oct 61
			Converted At:	Algiers LA	

Louisiana					
Length:	264'	Beam:	62'	Draft:	7'
Tonnage:	1,400	Speed:	2-3 kts	Crew:	300
Armor:	4" casemate; some sources state T-rails				
Armament:	Three 9" and four 8" Dahlgren smoothbores, two 7" Brooke and seven 32# rifles				
Authorized:	18 Sep 61	Launch:	6 Feb 62	Comm:	20 Apr 62
			Built At:	New Orleans LA	

Mississippi (never completed)					
Length:	260'	Beam:	58'	Draft:	14'
Tonnage:	1,400	Speed:	14 kts (planned)	Crew:	?
Armor:	3¾" casemate				
Armament:	(Planned) Four 7" Brooke and six 32# rifles, four 9" and six 8" Dahlgren smoothbores				
Authorized:	26 Aug 61	Launch:	19 Apr 62	Comm:	never
			Built At:	Jefferson City LA	

Missouri					
Length:	183'	Beam:	53'8"	Draft:	8'6"
Tonnage:	1,000?	Speed:	6 kts	Crew:	?
Armor:	T-rails (about 4")				
Armament:	One 11", one 9" and one 32# smoothbore				
Authorized:	1 Nov 62	Launch:	14 Apr 63	Comm:	12 Sep 63
			Built At:	Shreveport LA	

Mississippi waters:

Arkansas					
Length:	165'	Beam:	35'	Draft:	11'6"
Tonnage:	800?	Speed:	8 kts	Crew:	232
Armor:	T-rails (about 4") casemate, 2" pilothouse, ½" top; boiler iron on stern				
Armament:	Two 9" and two 8" Dahlgren and four 32# smoothbores, two 6.4" Brooke rifles				
Authorized:	24 Aug 61	Launch:	25 Apr 62	Comm:	26 May 62
			Built At:	Memphis TN (completed at Yazoo City MS)	

***Tennessee* (never completed).**

Note: Data for this table was extracted from several sources such as Raimondo Luraghi, 1996, *A History of the Confederate Navy*, Robert MacBride, 1962, *Civil War Ironclads: The Dawn of Naval Armor*, William N. Still Jr., 1985, *Iron Afloat: The Story of the Confederate Armorclads*. Many sources conflict on the specifications of the ironclads. For example, the *Richmond* type ironclads are often referred to as the "150' class," but this was the length of the keel from the break of the bow to the stern post. The length overall of these vessels was some 25' longer. Armament was changed throughout service life. This list disagrees with some published sources.

TABLE 2

SHIPS SUNK OR DAMAGED BY TORPEDOES DURING THE CIVIL WAR

Date	*Name*	*Service*	*Class*	*Tons*	*Location*	*Extent of Damage*
Dec 12, 1862	Cairo	MS	1GB	512	Yazoo River	S
Feb 28, 1863	Montaur	SABS	Monitor	844	Ogeechee River	D
Apr 6, 1863	Marion	Confed.	Transport	----	Ashley River	S
Apr 6, 1863	Ettwan	Confed.	Transport	----	Charleston	S
July 13, 1863	De Kalb	MS	1GB	512	Yazoo River	S
Aug 5, 1863	C. Barney	NABS	Gunboat	512	James River	D
Sept 1863	John Farron	U.S. Army	Transport	250	James River	D
Oct 5, 1863	New Ironsides	SABS	Ironclad	3,486	Charleston	D
Feb 17, 1864	Housatonic	SABS	Sloop of war	1,240	Charleston	S
Apr I, 1864	Maple Leaf	U.S. Army	Transport	508	St. Johns River	S
Apr 9, 1864	Minnesota	NABS	Frigate	3,307	Newport News	D
Apr 15, 1864	Easyport	MS	1GB	700	Red River	S
Apr 16, 1864	Gen. Hunter	U.S. Army	Transport	460	St. Johns River	S
May 6, 1864	Com. Jones	NABS	Gunboat	542	James River	S
May 9, I864	Harriet Weed	U.S. Army	Transport	290	St. Johns River	S
June 19, 1864	Alice Price	U.S. Army	Transport	320	St. Johns River	S
Aug 5, 1864	Tecumseh	WGBS	Monitor	1,034	Mobile Bay	S
Oct 28, 1864	Albemarle	Confed.	Ironclad	----	Plymouth	S
Nov 27, 1864	Greveound	U.S. Army	Transport	900	James River	S
Dec 7, 1864	Narcissus	WGBS	Tug	101	Mobile Bay	S
Dec 9, 1864	Otsego	NABS	Gunboat	974	Roanoke River	S
Dec 10, 1864	Bazely	NABS	Tug	50	Roanoke River	S
Jan 15, 1865	Patapsco	SABS	Monitor	844	Charleston	S
Feb 20, 1865	Osceola	NABS	Gunboat	974	Cape Fear River	D
Feb 20, 1865	Shawmut	NABS	Launch	----	Cape Fear River	S
Feb 22, 1865	Seultz	Confed.	Transport	----	James River	S
Mar 1, 1865	Harvest Moon	SABS	Wood steamer	546	Winyah Bay	S
Mar 4, 1865	Teorne	U.S. Army	Transport	403	Cape Fear River	S
Mar 6, 1865	Jonquil	SABS	Tug	90	Ashley River	D
Mar 12, 1865	Alyhea	WGBS	Tug	72	Blakely River	S
Mar 17, 1865	Bibe	SABS	Coast Steamer	----	Charleston	D
Mar 28, 1865	Milwaukee	WGBS	T. T. monitor	970	Blakely River	S
Mar 29, 1865	Osage	WGBS	Monitor	523	Blakely River	S
Apr 1, 1865	Rodolpe	WGBS	Tinclad G. B.	217	Blakely River	S
Apr 13, 1865	Ida	WGBS	Tug	104	Blakely River	S
Apr 14, 1865	Sciota	WGBS	Gunboat	507	Mobile Bay	S
Apr 14, 1865	Cincinnati	WGBS	Launch	----	Blakely River	S
May 12, 1865	R.B. Hamilton	U.S. Army	Transport	400	Mobile Bay	S

Abbreviations

NABS	-North Atlantic Blockading Squadron	S	- Sunk
SABS	- South Atlantic Blockading Squadron	D	-Damaged
T. T.	- Twin Turret	M S	- Mississippi Squadron
WGBS	- West Gulf Blockading Squadron	GB	- Ironclad gunboat

Notes: This table has been developed from *Notes on Naval ordnance of the American Civil War 1861-1865* which derived its data from the *Official Records of the Union and Confederate Armies* (OR) and the *Official Records of the Union and Confederate Navies (ORN)*. The various sources contain a number of contradictions which make absolute accuracy impossible.

TABLE 3

THE DIMENSIONS OF THE THREE CONFEDERATE SUBMERSIBLE BOATS

Vessel	Length	Beam	Depth
Pioneer	"34 feet" Letter of Marque, 1862	"4 feet" Letter of Marque, 1862	"4 feet" Letter of Marque, 1862
	"30 feet" McClintock to Maury, ca. 1871	"4 feet" McClintock to Maury, ca. 1871	
	"30 feet" Baird, 1902		
American Diver	"36 feet" McClintock to Maury, ca. 1871	"3 feet" McClintock to Maury, ca. 1871	"4 feet" McClintock to Maury, ca. 1871
	"about 25 feet" Alexander, 1902	"about 5 feet" Alexander, 1902	"about 6 feet" Alexander, 1902
H. L. Hunley	"40 feet" McClintock to Maury, ca. 1871	"3 1/2 feet" McClintock to Maury, ca. 1871	"4 feet" McClintock to Maury, ca. 1871
	"about 30 feet" Alexander, 1902	"about 4 feet" Alexander, 1902	"about 5 feet" Alexander, 1902
	"approx.39 ft 5 inches" 1996 survey	"approx.3 ft 10 inches" 1996 survey	"Between 4 and 5 feet" 1996 survey

Note: Data for this table was extracted from *Official Records of the Union and Confederate Navies (ORN)*, Mark Ragan, 1995, *The Hunley: Submarines, Sacrifice, and Success in the Civil War*, Alexander, W. A. 1902, *Thrilling Chapter In the History of the Confederate States Navy. Work of Submarine Boats,* and Baird, G. W. 1902, *Submarine Torpedo Boats*.

GLOSSARY

Blockade.	The investing of a coast by hostile naval force with intent to close it to maritime commerce. Legally this is a military action conducted against lawful belligerents and acknowledges the rights of an independent power.
Bolt.	A solid, bullet shaped projectile used by rifled artillery.
Breech.	The "closed" end of a cannon. See also. Muzzle.
Brooke Rifled Gun.	The Confederate Brooke Rifles (developed by the same Lieutenant John Brooke who was responsible for the *Virginia)* were quite similar to the Parrott rifles, the main difference being that, instead of one breech band, they were made up of several bands. In addition to solid shot, the Brookes fired spherical and conical shells, grape shot and cannister shells. The weight of a 7-inch Brooke was 15,500 lbs. and the range about 2,000 yards. The guns could be elevated by means of a large screw which passed through a lug at the breech. The smaller ones were mounted on a two-wheeled carriage which used a block and tackle recoil system. The larger ones were mounted as pivot guns, also using a block and tackle recoil system. On the ironclads a complicated system of gears, and a friction brake not unlike a modem automobile brake drum.
Caliber.	The diameter of the bore of a gun. Expressed in both inches (7-inch), and weight of its shot (42 pounder). A caliber of a rifled gun is the diameter of a cylinder that would touch all lands.
Canister.	A form of case shot where the projectiles are placed in a thin walled, cylindrical container that disintegrates upon firing. This creates a giant shotgun effect.
Cascabel.	The "knob" at the rear of the cannon barrel.
Case shot.	A general type of ammunition. By the Civil War, case shot consisted if both canister and spherical case, with the term often being substituted for the latter.
Casemate Ironclad.	A ship with an armored shield, or casemate, built on a low deck. Nearly all Confederate ironclads were of this type. Some, like the *Virginia* and *Atlanta*, were converted from other ship types. Others, like the *Arkansas* and *Tennessee,* were built from scratch.

City-class Ironclad. These paddle-wheel driven casemate ironclads were the Union's first operational ironclad vessels. A total of seven were built from scratch as warships, commissioned in January 1862, and named after northern cities. They were also known as "Eads Ironclads" (after their builder).

Close the Ports. The investing of a country's own coast by its national naval forces with intent to close it to maritime commerce. This action has historically been conducted against insurgents.

Commerce Raiders. A fast lightly armed ship operating on the high seas to conduct attacks against merchant shipping.

Cruiser. No ships were officially classed "cruisers" at the time of the Civil War, but the term is often used to describe Confederate raiders such as the *Alabama* and *Shenandoah*, and the Union vessels, typically screw sloops like the *Kearsarge* and *Hartford*, which opposed them. Shortly after the Civil War, the U.S. Navy introduced a class of ships called a cruiser. It was similar to a screw frigate in length and firepower, but had a single gun deck and narrow beam like a screw sloop.

Dahlgren Guns. The principal characteristic of the Dahlgren type (developed by Rear Admiral John Dahlgren before the war) was their bottle-like shape, the result of detailed studies of the explosion cycle in a smoothbore gun that indicated that the pressure of the expanding gases dropped off considerably towards the muzzle, as the shot was propelled forward. This indicated the need for a much heavier wall around the breech, and a lighter one towards the muzzle. This form permitted the use of much heavier charge needed to propel the new explosive shells, relatively lighter than solid shot of the same diameter, at velocities sufficient to penetrate wooden walls. When used against ironclads, solid shot were used with the same powerful charge. Dahlgrens were manufactured in a variety of sizes, the largest being the 15-inch shell gun, which weighed 42,000 pounds and had a range (when firing shells) of 1,700 yards.

Davids. Small semi-submersibles that were early variations of submarines designed to carry spar torpedoes to an intended target. They were not true submersibles--their smokestacks and air intakes were always above water.

Double-Ender. The Union built several ocean-going gunboats with rudders at both ends hoping this would make it easier for the vessels to back out of rivers where there was not enough room to turn around. The USS *Miami* was first of the class.

Floating Battery.	Essentially a ship (usually ironclad) without engines or with engines too weak to be used in combat. The Confederates used floating batteries to defend several Southern harbors.
Frigate.	A three-masted square-rigged ship (with or without steam power) with one full and one partial gun deck. Frigates were the largest ships to see action during the Civil War.
Groove.	The spiral cut placed into a smoothbore gun, designed to produce a spin on the projectile.
Gunboat.	Technically any armed vessel which was not a ship of the line, a frigate, or a sloop was a gunboat. The term, as it was used during the Civil War, is broad. It includes ocean-going sailing ships and steamers which, though small, could weather high seas and remain at sea for months. It also includes such ships as the Confederate ironclads and Union monitors which had the characteristic V-hull of an ocean going vessel, but had such a low freeboard that they could not stray far from the shelter of a friendly harbor. Finally, the term "gunboat" also includes all of the flat-bottomed armed riverboats, which spent their entire careers, a stone's throw from dry land.
Ironclad.	A boat or ship armored to a substantial degree with iron plate. There were ironclad ships in Europe before the Civil War, but until the *Virginia* and *Monitor* faced off, no two such ships had ever fought one another.
Land.	The portion of the original smoothbore remaining after the grooves are cut in order to produce a rifle.
Letter of Marque.	A commission issued by a government authorizing a private person to take the property of a foreign state. The armed cargo vessel served a dual purpose as a warship when the opportunity arose.
Monitor.	A class of vessels named after the first of their kind. Monitors were armored vessels with a low freeboard, shallow draft, and one or more revolving turrets. Thirty monitors (including seven river monitors) entered service during the war.
Muzzle.	The "opening" of a cannon.
Muzzleloader.	A gun that is loaded from the front by first placing the charge, then the projectile, in the muzzle of the piece and ramming them each

back to the firing chamber. Almost all Civil War cannon were of the variety.

Parrott Rifled Gun.	The principle of the Parrott gun was the same as that of the Dahlgren. the pressure at the breech is greater than it is towards the muzzle. Shrinking a 1-piece cylinder around the barrel at the breech strengthened the breech of the Parrott. This gave the Parrott a characteristic stepped appearance, somewhat like a telescope. The Parrotts were rifled, and fired either solid shot or shell. The largest Parrott, the 150 pounder, had an 8-inch bore diameter and weighed 16,500 pounds. Its range was 2,100 yards.
Privateer.	A privately owned vessel outfitted specifically and wholly as a warship as opposed to an armed cargo vessel, but carrying on maritime war under letters of marque.
Ram.	Any ship or boat equipped with an armored prow for ramming could be called a "ram." All Confederate casemate ironclads were also rams. The Union had a number of steamboats converted to use a ram as their primary weapon. These are usually called "army rams" because they belonged to the U.S. Army, not the Navy.
Rifle.	A cannon that has grooves cut spirally into the bore in order to put a spin on a projectile, increasing accuracy over longer distances.
Sabot.	(1) A wooden disk attached between the projectile and charge bag in fixed ammunition for smoothbores. (2) In rifled muzzleloaders, a deformable attachment at the rear of a projectile. Upon firing, the sabot would expand and contact the grooves, causing the projectile to spin.
Screw Frigate.	A steam-powered frigate driven by propeller (as opposed to paddle wheel). At the beginning of the Civil War the screw frigate was the dreadnought of its era. The *Merrimack,* before being converted to the Confederate casemate ironclad *Virginia,* was a screw frigate.
Screw Sloop.	A steam-powered sloop driven by propeller (as opposed to paddle wheel). The *Hartford, Brooklyn,* and *Kearsarge* were screw sloops, as was the Confederate raider *Shenandoah.*
Shell.	A hollow projectile for cannon with an explosive charge, set to explode in flight, on impact, or after penetration of an object.
Ship of the Line.	A three-masted square-rigged ship with two or more full gun decks. Ships of the line were the battleships of the Napoleonic era, but were obsolete by the Civil War. None of the Navy's five ships

of the line had seen active duty since 1850. Three were burnt at Norfolk Navy Yard in 1861; the other two were used as floating warehouses.

Shot. A sphere cannonball, normally solid. The weight of a shot made of cast iron was the traditional designation for the size of cannon that fired it. Sometimes called solid shot.

Side-wheeler. A steamship propelled by two paddle wheels, one on either side of the hull. Paddle wheels were not as efficient as propellers (screws), but were better suited for shallow water. Most of the larger paddle-wheel steamers were side-wheelers. The two wheels could be turned in opposite directions, giving the side-wheeler exceptional maneuverability.

Sloop. A three-masted square-rigged ship (with or without steam power) with one full deck of guns. More loosely, the term is used for any large ship with a single gun deck even though the rigging may have been fore-and-aft rather than square. The Confederate raider *Alabama,* for example, is generally classed as a sloop, though technically she was a fore-and-aft rigged bark.

Smoothbore. A cannon without rifling. Smoothbores were less accurate at long ranges, but canister was better dispersed from a smoothbore gun.

Spar Torpedo. An explosive charge fastened at the end of a long boom, or spar, at the bow of a ship. The ship would lower the spar into the water, ram it into or against an enemy vessel, and detonate the explosive with a lanyard.

Spherical Case. A hollow, spherical projectile containing bullets and a bursting charge. The shot was intended to burs in mid-flight, releasing the smaller bullets to fly towards the target in an increasing cone shape. Often mistakenly called caseshot.

Stern-Wheeler. A paddle-wheel steamer with a single paddle wheel in the stern (as opposed to one on each side). Many small steamers were stern-wheelers. The exposed wheel was difficult to protect, however, which led to several classes of vessels (most notably the city-class ironclads) being designed with a single paddle wheel near the center of the hull.

Strategy. The science and art of employing the political, economic, psychological, and military forces of a nation or group of nations to afford the maximum support to adopted policies in peace or war.

Submarine.	The Confederacy built several small submersible vessels. The most famous of these, the *H. L. Hunley,* sank the USS *Housatonic* but never returned from that mission. All true submarines of the Civil War period were hand-powered; the crew turned a crank which drove a propeller. There were also several steam-powered semi-submersibles like the spar torpedo boat *David* which operated with only their pilot house, intake duct, and smokestack above water.
Submarine weaponry.	Three types, inert obstructions, explosive obstructions (torpedoes), and hitting enemy hulls directly by means of submarine boats carrying explosive devices.
Torpedoes.	During the Civil War were moored or fixed mines. One version, the spar torpedo, consisted of a charge fixed to the end of a pole (spar), which detonated on contact with the target.
Tugs.	Tugboats were immensely important to both sides during the Civil War. They towed South's under powered ironclads into battle, then fought alongside them. Their powerful engines and sturdy hulls made them ideal candidates for conversion into ironclads, rams, and torpedo boats.

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